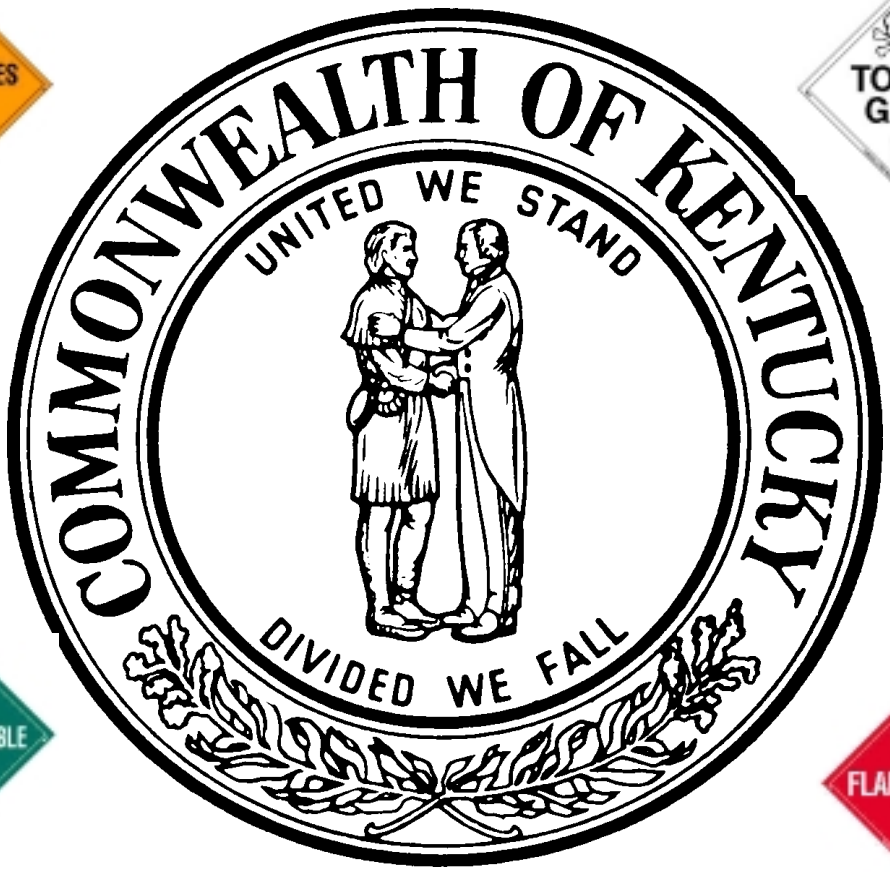


The Kentucky Emergency Response Commission Presents

First Responder Hazardous Materials Awareness

Course Format

This course is designed to be instructed in eight hours. The course should progress in 50-minute instructional segments with 10-minute breaks, although your instructor may choose to modify this. Your instructor will open the class with introductions and classroom logistics. You will be given approximately 45 minutes to complete the 30-question multiple choice test at the end of this class. The test will not be graded during your class, but will be returned to the KyEM Training Section in Frankfort for grading. You should receive a letter to present to your employer, a certificate of successful completion and a wallet card in the mail within about a month from the last day of class.

If you have not received your test results within six (6) weeks, feel free to contact your instructor or the Kentucky Division of Emergency Management's Hazardous Materials Training Officer at (502) 607-5732 or (502) 607-5731. You will need your class identification number that you should receive from your instructor during the class.

Course Design:

This course will use a combination of lecture, class discussion, case studies, and exercises based on actual Kentucky incidents to demonstrate operational concepts. This book has been developed as a tool to aid in the learning process, but also as a response tool. In the back of this book, you will find several resources intended to help you during the response phase of a hazmat incident.

Course Objectives:

The course objectives are determined by OSHA's 29 CFR 1910.120(q). The Kentucky Emergency Response Commission has chosen to supplement those objectives with the objectives from the National Fire Protection Association's 472 guidelines.

Your Goals

By the completion of this course, you will be able to a proficiency of 70%:

1. Demonstrate an understanding of the role of the first responder awareness level in the local emergency operations plan including site security and control and the Emergency Response Guidebook.
2. Demonstrate an understanding of the potential outcomes associated with an emergency created when hazardous substances are present.
3. Demonstrate the ability to recognize the presence of hazardous materials in an emergency.
4. Demonstrate the ability to identify the hazardous substances, if safely possible.

5. Demonstrate an understanding of what hazardous substances are and what risks are associated with hazardous substances in an incident.
6. Demonstrate the ability to realize the need for additional resources and the ability to make proper notifications to the communications center.

As mentioned above, upon successful completion of this course, which means receiving a score of 70% or above on the written test, you will receive a wallet card and certificate that shows you have met the requirements of the course. In addition, you will receive a letter you may present to your employer to confirm the level of class you attended, the score you received, and the name of your course manager. This letter is important since no one, except your employer, can certify you as a hazardous materials emergency responder in accordance with OSHA requirements.

Achieving Proficiency

The key to success in this course is class participation. Asking questions, participating in classroom activities, and taking notes increase your chances of capitalizing on this educational opportunity. This course is the first step in becoming a proficient hazardous materials first responder. It is the goal of the Kentucky Emergency Response Commission and the Office of the State Fire Marshal to have all responders trained to the **First Responder Operations Level**.

You will be given resources to use, such as the Emergency Response Guidebook (ERG). This book is a listing of the most commonly transported hazardous materials and the basic emergency procedures to follow for those substances. By the end of this course, you will be expected to be proficient in the use of the ERG to help you identify hazardous substances and implement initial safety procedures to protect yourself, your team, and the general public.

It is important that you do not let your training as a hazmat responder stop at this course. Classroom instruction is not enough in achieving proficiency in hazardous materials first response. If you have the potential to respond to hazardous materials emergencies, you must continue getting the most current training and taking time to study the results from case studies published by professional journals and institutions such as the National Institute for Occupational Safety and Health (NIOSH). Finally, there is no substitute for practical experience. Community hazardous materials exercises and actual events provide the best experience for keeping your skills and proficiencies sharp.

About your book

The manual you have before you has been compiled to serve two purposes. First, it serves as a tool to assist your learning in the class. Second, this book is intended to assist you in the field. The pictures in this manual have come from all over Kentucky. A special thank you to the dedicated emergency management professionals, hazardous materials response professionals, and the countless other who were so generous in providing the pictures for this manual. If you wish to have pictures you would like to see in future manuals, please contanct the KyEM Training Section for submission

information.

Another thanks goes to Patrick Conley, Training Supervisor and chief proofreader of this manual. In addition to Mr. Conley, thanks also goes to the Hazardous Materials Training Forum. This group was formed in the Fall of 2000 for the express purpose of guiding the development of the training curricula of the Kentucky Ememergency Response Commission Hazardous Materials Training Program. Finally, thanks to the Kentucky Emergency Response Commission, especially the Training and Education Committee. Without their guidance, support and dedication, this manual and program would not exist.

Chapter 1

Course Introduction

Danville/Boyle County
May 2000

Powell County 2000

Winchester/Clark County,
November 2000

Terminal Objective:

By the end of this chapter, the student will be able to demonstrate an understanding of the role of the first responder awareness level in the local emergency operations plan including site security and control and the Emergency Response Guidebook.

Enabling Objectives:

By the end of this chapter, the student should, to a proficiency of 70%, be able to:

1 Identify the role of the first responder at the awareness level during a hazardous materials incident.
2 Identify the location of both the local emergency operations plan and the organization's standard operating procedures/general operating guidelines.

Definitions:

OSHA
KRS
ERG
Hazardous materials/Hazardous substances
SARA
HAZWOPER
KyERC

LEPC

Welcome

Why on Earth would you, a public servant, spend the next eight hours learning about this scary potential for disaster? Perhaps you are **required** to learn how to deal with hazardous materials emergencies by your employer. Maybe you feel the need to expand your emergency service professionalism. Maybe, you have a strong concern about your safety and the safety of your teams.

Regardless of your motivation; whether you are volunteer or a paid firefighter, an EMT or paramedic, a public utilities worker, a law enforcement official, a member of the local emergency management team or Local Emergency Planning Committee, a member of local industry, or a concerned citizen, you are going to learn about hazardous materials and the possible threats they pose to you, your community, and your environment.

For many of you, this training may be "old hat". For others, it should be a new and enlightening course. Regardless, by successfully completing the Hazardous Materials Awareness course, you will be provided with information that can save your life and the lives of many others.

This course has been designed specifically for the emergency first responders of the Commonwealth of Kentucky. The examples and case studies presented throughout this course are ***actual incidents that have taken place in Kentucky*.** This course has been carefully developed for **"persons who are likely to witness or discover**

a release or suspected release of a substance that could cause harm to life, the environment, or property." These persons can also expect as part of their regular duties **"to initiate an emergency response system by notifying the proper authorities of the release."**

Each day, on the roads you travel, in the airways above your head, on the waters throughout the state, in the ground you tread, and the rails that wind through the Kentucky, there are vast amounts of hazardous substances being transported. Usually, these

Hazardous Materials are substances that can cause a serious threat to health, the environment or to property, such as this pipeline accident in Hebron (Boone Co) in 2000.

substances passes throughout your community without any problems, yet when these substances are spilled or used in improper ways, they can pose a **serious threat to your health, your environment, or property.**

Does this sound overly dramatic or even frightening? Unfortunately, it is true. And what may be even more frightening is the fact that, if you drive a vehicle on the roads; live around industry, railroads, or waterways; or if you respond to emergencies, you have a great potential to encounter a **hazardous materials incident**. A hazardous materials incident, or "hazmat" emergency as it is more commonly known, is an emergency incident that involves the release or potential release of a substance that is damaging to health, the environment, or property. In light of this fact, the authors of this book, your instructor, and your community want to know, "**Will you know what to do?????"**

It is the aim of the Kentucky Emergency Response Commission (KyERC), the Kentucky Division of Emergency Management (KyEM), and your instructor to teach you what to do should you encounter a release of a hazardous material.

By the end of this class, you will be able to: ***increase your awareness levels; increase your ability to detect and identify hazardous materials; and increase your proficiency in using the Emergency Response Guidebook.*** If we meet this goal, then the communities of the Commonwealth will be better protected from the potential dangers of hazardous materials. However:

THE NUMBER 1 GOAL OF THIS COURSE IS SIMPLE:

TO PREVENT YOU FROM BEING INJURED

WHEN RESPONDING TO HAZARDOUS

MATERIALS EMERGENCIES.

BACKGROUND

In the 1970's and 80's, after events such as the deadly chemical release in Bhopal, India, the federal government saw a need to intervene on behalf of citizens and emergency responders and pass **SARA, the Superfund Amendments and Reauthorization Act of 1986**. Prior to the passage of this legislation, too many responders who responded to incidents involving hazardous materials were being injured or killed. After the passage of SARA, not only was the safety of responders increased, but new provisions for the protection of the environment and the public at large were also created.

Title I of SARA directed **OSHA, the Occupational Safety and Health Administration**, to develop hazmat worker safety regulations. As a result of that directive, OSHA developed **29 CFR 1910.120, the Hazardous Waste Operations and Emergency Response (HAZWOPER) regulation**. This course meets the training required by Section of 29 CFR 1910.120(q) and **pertains to those who "are engaged in emergency response"** to hazardous substance releases. Chapter 336.040 of the Kentucky Revised Statutes assigns the Commonwealth of Kentucky's Labor Cabinet to oversee the occupational safety and health regulations for Kentucky. The Cabinet has adopted the federal OSHA regulations and enforces them.

The Kentucky Labor Cabinet, Kentucky Emergency Response Commission and Occupational Safety and Health Administration are concerned for your safety when a hazardous material is released and you respond. This is how the training you are receiving began.

In addition to the Labor Cabinet, **Kentucky Revised Statute (KRS) Chapter 39E.010 assigns responsibilities to the Kentucky Emergency Response Commission (KyERC) concerning hazardous materials response.** The KyERC members are appointed by the Governor to represent emergency response professionals, members of state and local regulatory agencies, environmental awareness groups, industry, and private citizens. Two important KyERC responsibilities are to develop training requirements for hazardous materials emergency responders and develop requirements for local governments and covered facilities to exercise community emergency plans required for hazardous substance response.

The KyERC recognizes OSHA's five levels of hazardous materials emergency responder training: **awareness, operations, technician, specialist, and on-scene incident commander**. Take a look at each level to learn the expectations and target audiences.

First Responder Awareness Level – **These individuals are likely to witness or discover a hazardous substance release. These individuals are trained to initiate the emergency response sequence by notifying the proper authorities of the release. The individuals would take no further action beyond notifying the proper authorities of the release.**

First Responder Operations Level – These are individuals who respond to releases or potential releases of hazardous substances as part of the initial response to the site for the purpose of protecting nearby persons, the environment, and property from the effects of the release. These individuals are trained to respond in a defensive fashion without actually trying to stop the release. Their primary function is to try to contain the release from a safe distance, keep it from spreading, and preventing exposures.

Hazardous Materials Technician – These are individuals who respond to releases or potential releases for the purpose of stopping the release. They assume a more aggressive role than a first responder at the operations level in that they approach the point of release in order to patch, plug, or otherwise stop the release of a hazardous substance.

Hazardous Materials Specialist – These individuals respond with and provide support to hazardous materials technicians. Their duties parallel those of the hazardous materials technician; however, their duties require a more directed and specific knowledge of the various substances they may be called upon to contain. They would also act as the site liaison with federal, state, local, and other government authorities in regards to site activities.

On Scene Incident Commander – These individuals will assume the control of the incident scene beyond the first responder awareness level.

As you can see, each level has an important role to play in a hazardous materials

emergency. This course is intended to train you to the **FIRST RESPONDER AWARENESS LEVEL**. This course curriculum has been reviewed and approved by the Kentucky Emergency Response Commission (KyERC). In addition to approving this class, KyERC has approved the instructor teaching your course. Your instructor is a highly qualified professional who has been trained in hazardous materials, has made responses to hazardous materials emergencies, and has honed his or her skills in providing instruction to emergency response professionals. Your instructor has gone through a rigorous review of his or her credentials and continues to receive the most current hazardous materials training in order that you may receive quality instruction.

Local Emergency Response Planning

In addition to the training you are receiving, 29CFR 1910.120 requires that the employer shall develop an emergency response plan for emergencies which shall address, as a minimum, the following:

- Pre-emergency planning and coordination with outside parties.
- Personnel roles, lines of authority, training, and communication.
- Emergency recognition and prevention.
- Safe distances and refuge.
- Site security and control.
- Evacuation routes and procedures.
- Decontamination
- Emergency medical treatment and first aid.
- Emergency alerting and response procedures.
- Critique of response and follow up.
- Personal protective clothing and emergency equipment.

It is possible to use a locally generated plan that contains the above elements, or to use the state emergency operations plan. Local agencies and businesses may use a local emergency operations plan, such as a county or city plan, in lieu of developing an individual agency plan. Regardless of what your agency or employer uses, **a plan is mandated by 29 CFR 1910.120.** In Kentucky, all counties have a local emergency operations plan, as do many of the larger towns and cities.

The Kentucky Emergency Operations Plan (KyEOP) is located on the Internet at:

http://kyem.dma.state.ky.us/kyeop.htm

"Annex Q" of the KyEOP deals specifically with hazardous materials, and "Appendix Q-7" addresses fixed facility response. Specific plans, required by SARA Title III, are created by the Local Emergency Planning Committee (LEPC) for your area in

cooperation with covered facilities such as water plants, farm stores and chemical manufacturing plants having Extremely Hazardous Substances. These facility plans are regulated by SARA Title III and then forwarded to the KyERC for review and approval. These individual plans are integrated into the local Emergency Operations Plan and then put into a place that is accessible 24 hours a day, 7 days a week. State law **requires** all responding agencies to respond in accordance with the plans developed by the LEPCs. At minimum, **the local emergency management director will have access to the local plan**. In addition, nearly 5,000 facilities annually send hazardous substance inventories to the fire departments that protect them, to the LEPCs and to the KyERC.

Should your agency use a local emergency operations plan or the State Emergency Operations Plan, it is necessary to write standard operating procedures/general operating guidelines (SOPs/GOGs) to support the plan. SOPs aid personnel in understanding the operational concepts being used by your particular agency. In addition, these SOPs can be attached to a local plan in order to become part of that plan to help other agencies in their response. SOPs should be put in a place where everyone has access to them. Also, they should be reviewed and updated periodically to ensure their adequacy. In addition the SOPs should be discussed and strictly adhered to during training.

Basic Safety Guidelines

Proper Training

Safety must be the foremost concern of hazardous materials responders. It is important that persons who have the potential to respond to hazardous materials incidents receive the proper training. **Through the proper training the risks of hazardous materials response can be reduced.** Too many responders are still being injured or killed needlessly because they lack the proper training and are unaware of the multiple hazards involved with hazmat response.

Essential to reducing the risk of hazardous materials response is to receive proper and current training.

Common Sense
One of the key assumptions of this training is that **you desire to protect yourself from injury.** If you rush into an incident to effect a rescue, or become a "hero" and are overcome by exposure to a hazardous material, you have now become part of the problem. It will now take two people, perhaps your friends or partners to place their lives in danger to rescue **you**. Therefore, it is vital that you use common sense to keep yourself safe. For example, don't touch, taste or smell any unknown substance.

Department of Transportation Guidelines
Every 3 – 4 years, the U.S. Department of Transportation, in cooperation with its Canadian and Mexican counterparts, produce a new version of the Emergency Response Guidebook (ERG). **This book provides a great deal of information that is helpful to the hazardous materials first responder during the first few minutes of the incident response**. Below are the guidelines from the ERG for approaching a suspected or known scene of a hazardous materials incident.

Approach Cautiously
Again, protecting yourself from injury is number 1. Page 6 of the 2000 ERG identifies a set of safety precautions: "Approach Cautiously from Upwind. Resist the urge to rush in; others cannot be helped until the situation has been fully assessed."

Secure the Scene
As an awareness level responder, you niether trained or equipped to stop the leak or contain the spill to protect the environment or others. However, you still must take actions to protect people from the hazards that are present. One of those actions is to isolate the area, keeping people away and outside a safe perimeter.

Identify the Hazards
You must assess the scene for the specific hazards presented by the hazardous material. As a hazardous materials first responder at the awareness level, you must have the knowledge to interpret the information presented by placards, containers, shipping documents, material safety data sheets, and other sources of information to determine the type of material involved and what the best course of action may be. Again the ERG is an invaluable source for the early minutes of the incident.

Assess the Situation
You should the following questions to determine ALL the hazards.

- √ Is there a fire, a spill, or a leak?
- √ What are the weather conditions?
- √ What is the terrain like?
- √ Who or what is at risk?
- √ What actions should be taken? Evacuation? Diking?
- √ What resources are required?
- √ What can be done immediately?

Obtain Help
Another important part of hazardous materials response is knowing your limitations as a responder. At the awareness level, you will have to call for help. Be certain to advise your headquarters, dispatch, and incoming agencies of the situation and request help as soon as possible.

Decide on Site Entry
Before you enter a site, you must have on the proper personal protective equipment. Next, you must consider if your effort to effect a rescue or protect the environment or property is possible. If you fail, you may become part of the problem. Most times, at the awareness level, you will choose not to enter because of your lack of training and equipment.

Respond
You must respond in an appropriate manner. Establish the incident management system and lines of communication immediately. Evacuate personnel and rescue victims when possible. You must maintain control of the site. Continually reassess the situation and be willing to modify the response efforts accordingly. Remember that your first duty is to consider the safety of yourself, and then the people in the immediate area.

Finally…
Use common sense on the scene, do not touch, smell, or walk into spilled materials. Stay away from smoke and vapors, even if it does not appear that hazardous materials are involved. Remember that just because your senses cannot detect the presence of hazardous materials does not mean they are absent. This means that smoking, drinking and eating at the scene of a hazardous materials incident is never allowed.

SUMMARY
Above all else, safety must be your first and foremost consideration. Your primary job at the hazardous materials first responder awareness level is to recognize and, if possible, safely identify the presence of hazardous materials and then initiate the emergency response plan so that you, your team, and the public at large can be protected from the potential effects of the release of a hazardous material.
In the most basic terms, at the awareness level, your job is to recognize the hazard, secure the are and deny entry and report what you have found to the appropriate authorities.

Chapter 2

Introduction to Hazardous Materials

Terminal Objective

By the end of this chapter, the student will be able to demonstrate an understanding of the potential outcomes associated with an emergency created when hazardous substances are present.

Enabling Objectives

By the end of this chapter, the student should, to a proficiency of 70%, be able to:

1. Identify the definition of hazardous materials.
2. Identify the difference between hazardous materials incidents and other emergencies.
3. Identify the DOT hazard classes and divisions of hazardous materials and identify common examples of materials in each hazard class and division.
4. Identify the primary hazards associated with each of the DOT hazard classes and divisions of hazardous materials by hazard class or division.

Definitions

Introduction

Did you know that in Kentucky, on any given day, hazardous materials are accidentally released into the environment? Sometimes, these releases are minor; such as when ammonium nitrate is spilled in a minor fender bender accident on New Circle Road in Lexington. Perhaps the spill is 250 gallons of diesel fuel from an overturned tanker on 25E just East of Corbin (Whitley County); perhaps over 250,000 gallons of whiskey is spilled into the Kentucky River in Anderson County. Or maybe, the release is not a spill at all, but smoke from a clandestine methamphetimine laboratory in rural Fulton County, releasing the highly toxic gas, phosgene.

Regardless of where or what the release of hazardous materials is, you will be responding. You may be a police officer, sheriff's deputy or state trooper; perhaps you are a firefighter or emergency medical technician; or maybe you are a member of the local emergency management agency or public works department. Nevertheless, you are responding to a potentially life threatening and environmentally damaging situation.

As emergency responders, daily you face dangers that are present in many forms, a drug crazed armed assailant; fast moving traffic; fire; or maybe falling debris. These hazards are usually very obvious. However, the risks presented by hazardous materials are more insidious. For example, in January several years ago on the East Coast, two police officers walked through a liquid on the ground and nothing happened. Sounds innocent enough right? However, the liquid called epichlorohydrin stayed on their shoes. When the officers got into their warm cruisers to respond to another incident, the liquid became a vapor in the closed car, and killed them. The officers never knew

what hit them…they just fell asleep…AND DIED.

Hazardous materials present a real danger because they act in different ways, they are often hard to detect, and are very prevalent in our homes, on our roads, in the air, and on the rails. The purpose of this is to teach you, the first responder, how to recognize, and if possible, safely identify the presence of hazardous materials at an incident scene.

A hazardous material is as any substance that has a potential, when released, to cause harm to the health of people or the environment or damage to property.
Picture provided by the Kentucky Natural Resources and Environmental Protection Cabinet.

WHAT ARE HAZARDOUS MATERIALS

There are several definitions that describe hazardous materials. An objective of this chapter is to define hazardous materials / dangerous goods. The U.S. Department of Transportation (DOT) defines hazardous materials as "chemicals and products regulated by Title 49 of the Code of Federal Regulations (49 CFR)." The items included in this definition are *explosives, radioactive materials, etiologic (disease causing) agents, flammable or combustible liquids and solids, poisons, oxidizing and corrosive materials, and compressed gases.* However, the Secretary of Transportation can designate something as a hazardous material when "it poses an unreasonable risk to health and safety or property."

The U.S. Environmental Protection Agency (EPA) uses the term "hazardous substances" to describe the "*elements, compounds, mixtures, solutions, and substances which, when released into the environment may present substantial danger to the public health or welfare or the environment*." In addition to this definition, Title 40 of the Code of Federal Regulations (CFR) Part 302 has a large list of over 62,000 hazardous substances.

Some of these substances are so dangerous to the health and environment, they are referred to as "Extremely Hazardous Substances" (EHS). If EHS's are released above

a specified reportable quantity,[4] that release must be reported to the Environmental Protection Agency through the National Response Center and to the Natural Resources / Environmental Response Team (NR/ERT).

The US Occupational Safety and Health Administration (OSHA) uses the term "*hazardous chemical,"* to define *any chemical that would be a risk to an employee's health if they would be exposed in their workplace*.

Each term has a legal meaning and is important to understand. However, for our purposes of recognition and identification, a hazardous material is defined as any substance that has a potential, when released, to cause harm to the health of people or the environment or damage to property. These could be substances such as industrial products like chlorine and acids to everyday substances such as milk.

Why are Hazardous Materials Incidents Different From Other Incidents?

As mentioned above, hazardous materials can be more menacing than other hazards on an emergency scene. There are many factors that contribute to the challenges of hazardous materials incidents. Among the top factors are the characteristics of hazardous materials or hazmat, the prevalence of hazmat in our everyday lives, and the challenges of past training.

Wide-ranging Characteristics

A hazardous material is defined as any substance that has a potential, when released, to cause harm to the health of people or the environment or damage to property. However, these substances do not have any uniform characteristics other than that. They can be in any form, solid, liquid, or gas. They can be odorless and colorless. They can be very potent. In essence, some hazardous materials can go completely undetected until it is too late. There are signs that you can use to help verify the presence of hazardous materials, and tools that you can use to help determine the hazards. By using these signs and tools, you will know the immediate actions to take to protect yourself and the general public.

Prevalence of Hazardous Materials

As our technology advances, chemicals are being manufactured in greater quantities and in more powerful concentrations. According to the Chemical Abstract Service (CAS), a division of the American Chemical Society, there are 27 million chemical formulations with 50 new substances being added every week. This compares to only 1.5 million chemical formulations in 1995. Of these 27 million chemicals, over 223,000 substances are considered hazardous.

In many cases the chemicals are produced at a manufacturing facility and then transported in bulk to other sites. This transportation takes place over the road, on rails, on the water, in the air, or by way of pipelines. Think about driving down the interstate highways or any of the parkways in Kentucky. How many tank trucks have you seen? Probably more than you can remember. Many of those tank trucks can carry up to 9,000 gallons of liquid. According the Kentucky State Police, in 1999 there were over 100 accidents involving trucks carrying hazardous cargo. However, it is important to note that of these accidents, only 15% of these accidents took place on

Interstates. The remainder of these accidents involving trucks carrying hazardous cargo took place on county roads, city streets, US, or state numbered routes. This is why all departments should be trained in hazardous materials response, as well as those who respond to accidents on the Interstates.

Hazardous materials take place in almost every setting. This was a spill of diesel fuel and motor oil in rural Lewis County. Is your department or agency prepared to deal with a spil like this?
Photo provided by Natural Resources and Environmental Protection Cabinet

Since 1990, the Agency for Toxic Substances and Disease Registry (ASTDR) has maintained a state-based Hazardous Substances Emergency Events Surveillance (HSEES) system to explain the public and environmental health costs and property damage associated with the release of hazardous substances. In a 1997 study, a total of 5,531 events in 14 states were analyzed. Of these events, eighty percent (80%) took place in fixed facilities, while the other twenty-percent (20%) took place in transportation accidents. Of the transportation accidents, over eighty percent (80%) of these accidents happened on the roads. It is important to realize that fifty-nine percent (59%) of these incidents were due to equipment failure, including safety devices.

Kentucky has had its fair share of hazardous materials incidents. From October 1, 1999 to September 30, 2000, there were over 2,100 incidents involving hazardous materials releases into the environment in Kentucky according to the Division of Emergency Mangement's 24 hour emergency communications center. All of these statistics point to one fact: the prevalence of hazardous materials is growing larger everyday, bringing an increased **potential for hazardous materials incidents.**

Overcoming the Challenges of Past Training

Past training has stressed taking immediate action for all types of incidents, including hazardous materials, however, that approach can be deadly. Response to hazardous materials incidents requires a deliberate and informed response. This is why the consideration of the safety aspects of hazardous materials response is so important to the responder.

Why are there no Hazmat Experts?
Multi-Disciplined Field

It takes many people to make a safe, effective and efficient response to the release of a hazardous material. The field of hazardous materials is so complex, no one person can be an expert in hazardous materials. Photo by Logan Weiler, KyEM Area 13 Manager.

First, the field of hazardous materials is a multi-disciplined approach. No one individual has the ability to absorb all of the information needed to deal with all of the hazardous materials used in today's society. An individual may have the expertise of one or two fields, but it is impossible for anyone to be well versed in all areas of hazardous materials.

Hazardous Materials Are Dynamic

As you have learned above, there are almost daily additions to the "list" of hazardous materials. In addition, scientists are always learning more about the over 27 million substances being used. The new information is overwhelming and constantly changing. New information becomes outdated quickly. Many reference materials that were valid a couple of years ago are no longer appropriate for response. What's more, planning responses with outdated materials or using outdated materials during a response can be harmful to the responders, the public, and the environment.

What are the threats posed by Hazardous Materials?

Before we can discuss the threats presented by hazardous materials, you need to understand the classes of hazardous materials. The U.S. Department of Transportation (DOT) has made your job easier by dividing thousands of chemicals into nine categories. Table 1.1 shows the DOT Hazard Classes and Divisions.

For detailed specifications of each class, you can look in 49 CFR Sec 173. On the table you will find an explanation of the class, examples of the class, and examples of general hazards offered by the class. These are not all-inclusive, but should give you a general idea of each class.

Class 1 – Explosives

Explosives are split into six divisions depending on the severity of their hazards. This is class is important since Kentucky is among the top states for use of explosives, due largely to the mining in the east and west. **Division 1** pertains to explosives with a mass explosion hazard. These are determined by how long it takes the material to be completely consumed. Usually, the consumption time is less that one tenth of a second. The primary mechanisms of injury come from pressure waves and thermal exposure at detonation. Also, the force of the explosion can throw items for hundreds of feet.

Division 2 includes objects with a "projectile hazard," meaning that when the object detonates, it throws out pieces of the container or other objects contained within the device. Hand grenades and blasting caps are examples of this division. Again, the consumption time is less that one tenth of a second.

Division 3 is an explosive with a fire hazard. If you have ever had a model rocket, the small motor, a chemical wrapped in heavy paper, is a smaller scale example of this division. Commercial fireworks are also examples of this division. The consumption time of this is greater than one-tenth of a second, but usually less than one second. The hazard of this is the fire created when these materials explode.

Gases may be under extreme pressure, liquified or compressed. This LP Gas tank is a good example of a gas container. Notice the rounded ends and housing on the top.

Division 4 is probably the most commonly encountered, with examples including ammunition and fireworks. **Division 5** is ANFO – ammonium nitrate and fuel oil mixtures. These mixtures are very stable, which means they are not sensitive to friction or shock, however, they have a mass explosion hazard. **Division 6** of this class is extremely insensitive explosives.

Class 2 – Gases

Gases are divided into three divisions. **Division 1 covers Flammable gases** that burn with a concentration of at least 12% in normal air. They do not have a pressure of more than 14.7 pounds per square inch. **Division 2 applies to non-flammable, non-toxic or compressed gases.** These gases can be compressed by pressure or cryogenically. The hazards of pressurized containers present are significant! Some vessels are kept at pressures over 2,000 psi. If the container should fail, the rapidly

DOT'S HAZARD CLASSES AND DIVISIONS				
CLASS	**IV**	**EXPLANATION OF CLASS/DIVISION**	**EXAMPLES OF MATERIALS**	**GENERAL HAZARDS (NOT ALL INCLUSIVE)**
1	**EXPLOSIVES**			
	1.1	**Explosive with mass explosion hazard.**	Dynamite and TNT	Explosive. Exposure to heat, shock or contamination could result in thermal and mechanical hazards
	1.2	**Explosives with a projection hazard**, but not a mass explosion hazard.	Projectiles with bursting charges; hand grenades	
	1.3	**Explosives with a fire hazard** and a minor blast hazard or projection hazard or both; but not a mass explosion hazard.	Rocket motors, propellant explosives, special fireworks	
	1.4	**Explosives that present a minor explosion hazard** – no projectiles	Common fireworks; ammunition	
	1.5	**Very insensitive explosives** – mass explosion hazard	Ammonium nitrate – fuel oil mixtures (ANFO)	
	1.6	**Extremely insensitive explosives** – no mass detonation hazard		
2	**Gases**			
	2.1	**Flammable Gas** – any gas which has a pressure of less than 14.7 psi and ignites at a concentration of at least 12% with air.	Propane, butane, acetylene	Under pressure; container may fail with or without fire; may be flammable, toxic, corrosive, an asphyxiant, and/or thermally unstable.
	2.2	**Non-flammable, non toxic, or compressed gasses**	Carbon dioxide, anhydrous ammonia	
	2.3	**Toxic Gases**	Phosgene, chlorine, methyl bromide	
3	**FLAMMABLE OR COMBUSTIBLE LIQUIDS**			
		Flammable Liquid – any liquid with a flash point of 141° F or below; or any substance in a liquid form with a flash point of 100°F or above and is transported at or above its flash point.	Gasoline, methyl alcohol, acetone	Flammable; container may fail due to heat or fire; may be corrosive, toxic and/or thermally unstable
		Combustible liquids similar to flammable liquids, but have a flash point above 141° F and below 200 F.	Fuel Oils	
4	**FLAMMABLE SOLIDS**			
	4.1	**Flammable Solids** – desensitized explosives; self reactive materials; and readily combustible solids	Matches	Could cause thermal burns.
	4.2	**Spontaneously Combustible Materials** – pyrophoric materials and self-heating materials	Phosphorus, charcoal briquettes	

DOT'S HAZARD CLASSES AND DIVISIONS (CONTINUED)				
CLASS	DIV	EXPLANATION OF CLASS/DIVISION	EXAMPLES OF MATERIALS	GENERAL HAZARDS (NOT ALL INCLUSIVE)
	4.3	**Dangerous when Wet Materials** – a material that, by contact with water, is liable to become spontaneously flammable or give off flammable or toxic gas.	Calcium carbide, potassium	
5	**OXIDIZERS AND ORGANIC PEROXIDES**			
	5.1	**Oxidizers –** A material that may cause or enhance the combustion of others, by releasing oxygen.	Ammonium Nitrate, oxygen	Sensitive to heat, shock, friction, and/or contamination
	5.2	**Organic Peroxide**	Bezoyl peroxide	
6	**TOXIC MATERIALS AND INFECTIONS SUBSTANCES**			
	6.1	**Toxic Materials –** a material other than a gas, that is known to be so toxic to humans as to afford a health hazard.	Carbon tetrachloride	Toxic by inhalation, ingestion, and skin and eye contact; may be flammable
	6.2	**Infectious Substances** – a substance that causes disease in humans or animals	Anthrax, botulism	
7	**RADIOACTIVE MATERIALS**			
		Radioactive materials	Cobalt, uranium hexafluoride	ay cause burns and biologic effects; may be in the form of energy
8	**CORROSIVE MATERIALS**			
		Corrosive Materials – a liquid or solid that causes full thickness destruction of human skin or a liquid that can cause the destruction of aluminum or steel.	Sulfuric acid, mercury,	Takes place at the site of contact; may be fuming or water reactive
9	**MISCELLANEOUS MATERIALS**			
		Miscellaneous Hazardous Materials – a material that presents a hazard during transportation but does not meet any other hazard class definition	PCB's, dry ice	Could cause annoyance or discomfort; hazardous waste
ORM-D		**)ther Regulated Materials –** consumer commodities that present a hazard during transportation due to its form, packaging, or quantity	:onsumer commodities – batteries, HTH	Class is misleading; could have any of the above hazards

escaping gas could cause pieces of the container to fragment and become airborne. **Division 3 includes toxic gases**. These gases are toxic by inhalation. This means that they pose a significant hazard to anyone or anything that might inhale them. The Occupational Safety and Health Administration (OSH) has set permissible exposure limits (PELs) that are caps for many of these chemicals.

Other parts of this class, although not divisions, are *liquefied compressed gases and cryogenic liquids*. Liquefied compressed gases are substances that at normal atmospheric pressure would be in a gaseous form, but are kept in a liquid form by high pressures. LP Gas is an example of a liquefied compressed gas. Cryogenic liquids are gases that are kept in liquid states by the use of extremely cold temperatures. Although they may not be under pressure, they are extremely cold, in many cases under -100° F. You must also be aware of the potential for frostbite by contacting cryogenic liquids.

Canadians use a fourth division called "corrosive gas." Anhydrous ammonia is an example of this division. It is advantageous to understand how the Canadians classify hazardous materials, especially since the Canadian government owns the rail line that runs through several counties in the Western part of the state.

Class 3 – Flammable and Combustible Liquids

Flammable and combustible liquids are some of the most common hazardous materials on the road today. These are classified together based on flash points. The flash point for flammable liquids is less than 141° F. This is important when one considers the possible sources of heat and ignition on the incident scene.

141° F is a temperature easily surpassed by the surface temperature of the engine block of most emergency response vehicles. Examples of Class 3 are fuel oils and gasoline.

Class 4 – Flammable Solids

This class is separated into three divisions. **The first division is flammable solids**. These materials range from explosives that are wetted or plasticized in order to suppress the explosive properties, to materials that can decompose with or without air, creating an *exothermic reaction* that produces a great amount of heat. A highway fusee is an example of this division.

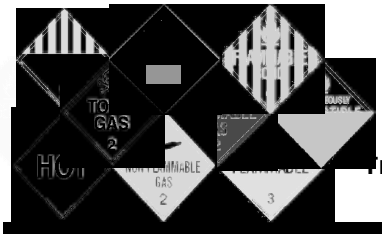
The **second division is spontaneously combustible solids.** This division includes pyrophoric materials. The materials will react in air or with moist air. An example of this are phosphorus. These materials are usually stored in a solution with kerosene or an inert gas, such as nitrogen.

The **third division of flammable solids includes materials that are dangerous when wet.** Sodium metal is a good example of this division.

Class 5 – Oxidizers and Organic Peroxides

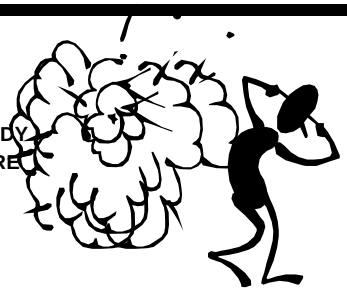
Oxidizers are materials that may cause or enhance the combustion of a material by releasing oxygen. Ammonium nitrate fertilizer is a good example of this division. Organic peroxides are chemicals that are related to hydrogen peroxide. They are

Hazards and Classifications



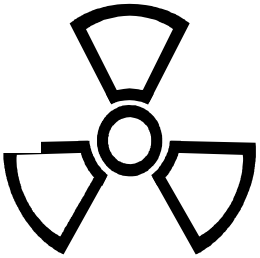
THERMAL – EXPOSURE TO HEAT OR COLD

MECHANICAL – CAUSED BY THE BODY BEING HIT BY DEBRIS OR A PRESSURE WAVE

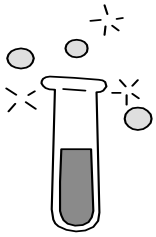


CORROSIVES – CAUSED BY BODY TISSUES BEING DAMAGED.
POSIONS/TOXINS – SYSTEMIC REACTIONS TO A SUBSTANCE.
ASPHYXIATION – OXYGEN IS DISPLACED OR ABSORBED SO THE BODY HAS LITTLE OR NONE TO PROCESS.

RADIATION – burns and internal damage caused by exposure to radioactive materials.



ETIOLOGIC – CAUSED BY MICROORGANISMS OR TOXINS PRODUCED BY MICROORGANISMS THAT CAUSE DISEASE IN HUMANS.



materials that chemically "hold" oxygen. They have a serious explosion hazard.

Class 6 – Toxic Materials and Infectious Substances (Etiologic Agents)

Toxic materials are materials, other than gases, that are known to be toxic to humans such as the pesticide called lindane. As mentioned above with the Division 2.3 – Toxic Gases, the main concern is with inhalation. However, there are other ways of being exposed to the toxic materials. *Oral* (by mouth) exposure, *dermal* (skin) exposure, and *inhalation* exposure are possible routes of exposure to toxic materials. Infectious substances are microorganisms that either make people and animals sick, or produce a toxin that makes people and animals sick. Infectious substances can also be substances such as urine, blood, feces, body tissues, or other bodily fluids being shipped for diagnostic purposes. Also meeting this criterion are vaccines and regulated medical waste. Again, as a rescuer, you need to be concerned about dermal, inhalation, and oral exposures to the substances. Rescuers should also be aware that effects from exposure to these substances might be delayed from several days to several years.

Class 7 – Radioactive Materials

Radioactive materials are more and more prevalent on the roads and in the communities of Kentucky. Hospitals, industry, and academic institutions are using increasing amount of radioactive materials. The first wave of nuclear reactor rods are being retired and shipped to facilities for disposal. Therefore, responders in the state have a greater possibility of encountering an incident involving radioactive materials. The risks with these materials are burns and biological effects, better known as radiation sickness. Although radiation burns might exhibit quickly, the biological effects might be delayed. The best defenses in dealing with radiation incidents are time, distance and shielding. This will be addressed in future chapters.

Class 8 – Corrosive Materials

Class 8 materials are corrosives. These could be in the form of a liquid or a solid. The main criterion is that the substance causes full thickness destruction of the human skin at the point of contact within a specified period of time. A liquid that has a severe corrosion rate on steel or aluminum also qualifies. Some chemicals in this class are sulfuric acid, mercury, and lime. Exposures to these chemicals usually take place through contact with bare skin. However, some chemicals, such as fuming nitric acid, produce significant vapors. This opens the possibilities for exposure through inhalation. Some chemicals, such as sulfuric acid, have violent exothermic reactions with water. Although contact sites are almost immediately obvious, some exposures may not be immediate.

Class 9 – Miscellaneous Materials

Miscellaneous hazardous materials are the catchall for other hazardous materials. This class is where substances that are hazardous, but do not fit any other classification are assigned. Usually, substances that are assigned here have lower levels of hazard. However, they should be treated as if they had the same hazard as explosives or radioactive materials.

ORM – D and HOT Substances

These are not classifications made by the Department of Transportation. However, they are significant groups of hazardous materials to recognize. ORM-D (Other Regulated Materials) is a group of hazardous materials that are consumer commodities. This means that they present a limited hazard during transportation due to quantity, form, or packaging. For example, the material used to treat most home pools is called HTH, sodium hypochlorite. If it were shipped without individual packaging, it would be considered a toxic material. However, when it is shipped to Wal-Mart in individual packaging it receives an ORM-D classification. The point is that these materials may have a greater hazard than what the ORM-D classification may indicate.

HOT substances are liquid substances being transported above a temperature of 212° F or intentionally heated above their flash point; or they are solids at a temperature at or above 464° F. Asphalt and many molten metals are examples of this group.

Risks

Now that we have identified the different classes of hazardous materials, it will be easier to discuss the risks one may encounter when responding to a hazardous materials incident. Why do you really care about the risks associated with hazardous materials? You should care because hazardous materials can cause death or severe harm to individuals in a number of ways.

There are physical hazards such as thermal hazards, caused by exposure to heat. There is mechanical trauma that is caused by the body being hit by debris or a pressure wave.

There are health hazards such as chemical hazards, often caused by corrosives destroying the skin. Other chemical hazards are caused by poison/toxins that create a systemic reaction in the human body. Finally, there are chemicals that asphyxiate by displacing or absorbing oxygen, leaving no oxygen for the body to use.

There are radiation hazards that can cause burns or severe internal damage. Also, there are etiologic effects caused by microorganisms or toxins produced by microorganisms that cause disease in humans.

As we said above, there are several routes of exposure. These routes are orally (ingestion), inhalation, injection, and absorption (dermal) through skin or eye contact.

Hazardous Materials and the Environment

Do you remember the definition of a hazardous material? **Hazardous materials are any substances that present a danger to people, the environment, or property.** So far, you have heard about how hazardous materials affect the human body, but now, you need to understand how a hazardous material can damage the environment. **The environment is defined as all external factors affecting an organism**, including biotic factors (other living organisms) and abiotic factors (nonliving variables), such as water, soil, climate, light, and oxygen. The organism in question is you. In other words, your environment is all things surrounding you that have an effect on you. The concern for the environment during and after a hazardous materials spill is how will this substance affect the living creaturesin the air, water and soil. Pollution, which

may be described as a prolonged release of hazardous materials into the environment, causes different concerns. For the purposes of this class, only the acute release of hazardous materials will be addressed.

Hazardous materials can contaminate the water table and the soil irreparably. What is worse is that the severity of the damage may not be fully known for decades after the spill. Kentucky is a largely rural, agricultural state, which means that there is great dependence on the soil and water that is used to nurture the crops. If a tract of land were contaminated and considered to be unsuitable for agriculture, it could literally ruin a farm family. Consider the hazardous materials spill in the Kentucky River in

The white specs in this picture are some of the 1,000,000 dead fish when 250,000 gallons of aging whiskey were dumped into the Kentucky River near Lawrenceburg (Anderson County) in May 2000. Photo provided by Natural Resoures and Environmental Protection Cabinet.

May, 2000. On May 6th, 2000, a warehouse near Lawrenceburg (Anderson County) storing 250,000 gallons of whiskey caught fire. The barrels containing the liquid whiskey were destroyed during the fire, spilling the majority of the 250,000 gallons onto the ground and into the Kentucky River. What resulted was a devastating “fish-kill” that killed over one million fish in less than three weeks. Grass and trees on the hillside were damaged as the flaming liquid ran down the hill.

Another example took place in Henry County. A gasoline tank truck overturned, resulting in a major spill of gasoline on to the ground. The vapors found a heat source and ignited. Severe smoke left residue on the ground and increased the amount of carbon dioxide and carbon monoxide in the air. The soil was so badly contaminated that it had to be scooped up and taken to an incinerator for disposal.

A final example took place near Burgin (Mercer County) in September 1999. Over 40,000 gallons of diesel fuel were spilled at a local electricity generating plant. The fuel contaminated the ground, and although it did not ignite, the odor of the fuel could be detected for 10-15 miles from the spill.

There are three main concerns that you should have for the environment as it relates to hazardous materials releases, the air, water, and the soil. At the awareness level of first response you should remember your responsibilities, notifying the proper personnel of the release. At the operations level, responders are given the knowledge to confine the release, thus protecting the environment.

Air

The air is essential for survival. Without air, or rather the oxygen in that air, human life will cease, as will most other forms of life. Therefore, your concern must lie, at least in part, with the air. As mentioned above, some substances have the ability to displace oxygen. This has an effect on animals and human life by creating conditions that make asphyxiation probable. The major concern for releases of hazardous materials into the air is the concentration and direction of the wind. Smoke from fires involving hazardous materials are also a concern, because as a substance burns, it may be transformed into a completely different and potentially more hazardous substance.

Water

The water is important for life and agriculture. Without water, life will cease. Substances can have variable reactions with the water. For example, large amounts of milk and alcohol can rob the oxygen from the water as bacteria break them down. Other substances, such as potassium and sodium, can have violent reactions with the water,

This accident near Vanceburg (Lewis County) contaminated the ground so severely, that the ground had to be excavated, packaged and burned. The photo on the right is a close up of the lightened area in the left-hand photo. Photo provided by the Natural Rescources and Environmental Protection Cabinet.

resulting in an explosive reaction and contamination of the water.

A major concern for the hazardous materials first responder is runoff from firefighting. As with smoke, runoff can contain the original substance or a substance that is transformed and potentially more dangerous than the original substance. Many substances are not fit for human consumption. Therefore, if this substance were spilled into the water that is used for drinking, the water could poison or harm people.

Soil

The soil is important for the nourishment of plant life and many foraging animals. If the soil is contaminated, in many cases, the soil is scooped up and taken away for burial, incineration, or some other means of disposal. The reason is that the soil can no

longer safely support life. Liquids and gases that are heavier than air can pose the greatest risk to soil contamination, although solids can be mixed with loose soil and also cause contamination.

INTERVENTION

Now that you have learned about the classes of hazardous materials and the potential harm that hazardous materials can create to humans and the environment, it is time to discuss the reasoning for intervention. From the beginning you have heard and read that a hazardous material is any substance that present a danger to people, the environment, or property. Therefore, **the purpose of intervention during a hazardous materials incident would be to change the order of the natural events to minimize the harm done the public, the environment, and/or property that would occur by natural stabilization.**

Reduce Harm to People, the Environment, and Property

As an emergency responder, you must realize that in time all hazardous material incidents will stabilize in time, even if no intervention was made. However, during this stabilization, hazardous materials can injure, disable, or kill humans; cause irreparable damage to the environment and cause damage to property.

It is important that before intervention, you, as an emergency responder, determine the most probable outcome of natural stabilization. If harm is predicted as an outcome, then you must examine your ability to reduce the harm by intervention. Then you must evaluate the likelihood of harm occurring to the emergency responders during the intervention.

Finally, you may only decide to intervene if the harm to the emergency responders or to the environment **does not exceed** any harm prevented by their intervention. The flowchart below illustrates this point.

Weighing Risk vs. Benefit

The first question to ask before beginning the intervention is, “Can I reduce the harm?” In answering this question, language such as cost and gain becomes important. The difference between the gain and the cost is a measure of the extent that your intervention can have on positively influencing the natural stabilization at a minimum risk to life, environment, and property.

The next question that you must ask is, “What effect will my actions have on the outcome?” The laws of physics teach us that for every action, there is an equal and opposite reaction. As an emergency responder, you need to be aware that every action you take has an effect.

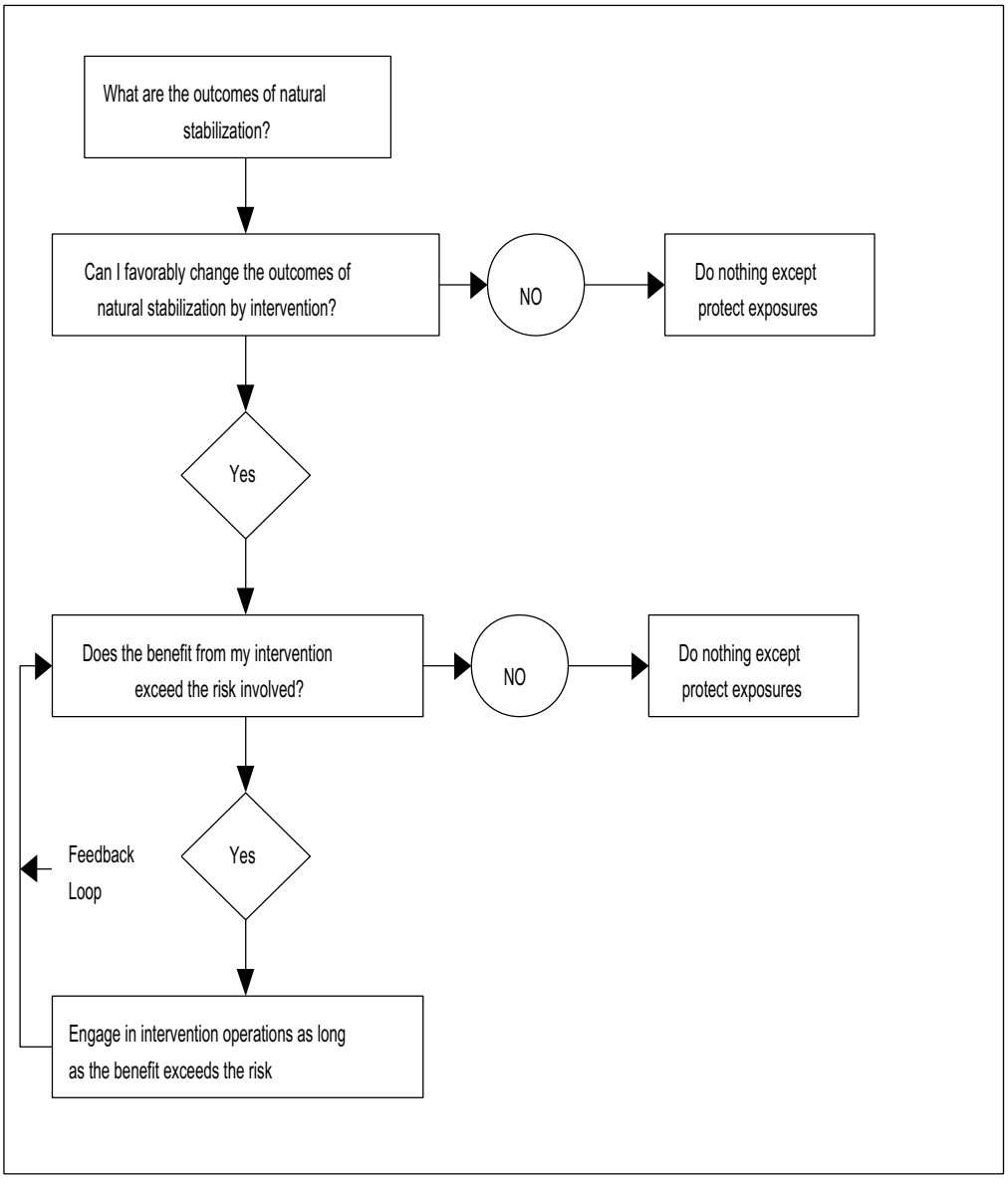
Establish Response Guidelines and Priorities

It is impossible to design specific procedures that cover all possibilities because there can be multiple ways of handling a single incident. Your goal is to remove the threat(s) to the general public, the environment and property that a hazardous materials incident may pose. However, each hazardous materials incident shares enough common factors so that safety procedures can be designed and utilized for your protection.
There is a set of basic priorities that you should follow on a hazardous materials incident. Life safety is the number one priority. Let’s review that again

LIFE SAFETY IS THE NUMBER ONE PRIORITY

The primary goal of every rescue should revolve around saving lives. This includes your life as the rescuer as well as the lives of the bystanders and the lives of any victims. As an emergency responder you assume a certain amount of risk, however your life is not expendable or traded for the life of a victim.

Your secondary goal on a hazardous materials incident is protecting the environment. The environment can take weeks, or months, or even decades to recover from the effects of a hazardous materials spill. Remember that property and equipment can always be replaced. Finally, **protecting equipment and property is the third priority**. These things can be replaced, the environment and human life cannot.



Review

Hazardous materials are defined in different ways by various agencies. However, for the first responder, hazardous materials/dangerous goods are defined as any substance that has a potential, when released, to cause harm to the health of people or the environment or damage to property. Incidents involving hazardous materials differ from other incidents due to the wide-range of characteristics of hazardous materials, the prevalence of hazardous materials in the U.S., and the challenges presented by past training that have taught responders to rush in. Hazardous materials response requires a careful and deliberate approach.

There are three different forms a hazardous material might be in: gas, liquid, or solid.

There are nine classifications of hazardous materials defined by the U.S. Department of Transportation. Some of these classifications are broken down further into divisions based on unique hazards within the classifications.

Hazardous materials not only present dangers to the health of humans, but also to the environment and property. Although substances are not chemically hazardous, they may present danger to humans, the environment, and property because of their temperature, packaging, or quantity.

There are five general types of dangers presented by hazardous materials: thermal, mechanical, chemical, radiation, and etiologic.

While the effects of most thermal, mechanical and corrosive substances, some toxic and asphyxiating substances, and some radioactive substances can be seen almost immediately, the full effects of exposure to hazardous materials may not be realized for several days, weeks, or even months or years.

The routes of exposure are absorption, ingestion, inhalation, and injection.

Explosives, flammable liquids and gases (if ignited), compressed gases, present a danger of internal injuries through blunt force trauma due to the force of an explosion. They present a danger of penetrating trauma if pieces of their containers or foreign debris are thrown in an explosion.

Flammable substances and materials labeled “HOT” can present a danger of thermal (heat) injuries if they are ignited, while compressed liquid gases and cryogenic liquids can present a danger of thermal (frostbite) injuries if they contact the skin.

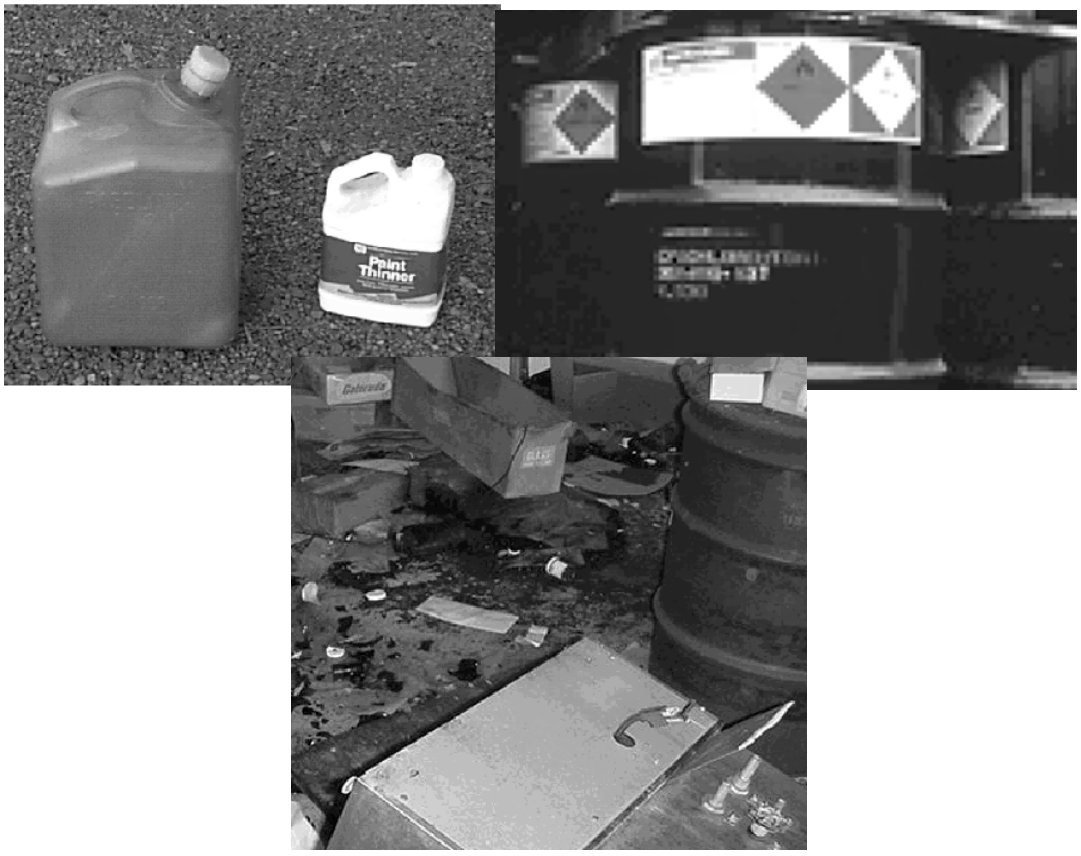
Corrosive materials can instantly damage human skin as well as steel and aluminum. Radioactive materials can cause burns as well as internal damage that may go unseen for a significant period of time.

Infectious substances/etiologic agents are microorganisms that may cause disease or produce toxins that may cause disease to humans and animals. They may come in the form of bodily fluids, tissues, vaccines, or regulated medical waste.

Miscellaneous hazardous substances and ORM-D materials could have hazards of many of the other classes, but do not meet the criteria of any particular class.

Chapter 3

Detecting the Presence of Hazardous Materials



Terminal Objectives

By the end of this chapter, the student will be able to:
When given various facility or transportation emergency situations, or both, with and without hazardous materials present, identify those situations where hazardous materials are present and identify the hazardous substances, if possible. In addition, the student will be able to analyze the incident to determine the basic hazard and response information for each hazardous material.

Enabling Objectives

By the end of this chapter, the student should, to a proficiency of 70%:

1 Identify examples of clues (other than occupancy/location, container shape, markings/color, placards/labels, MSDS, and shipping papers) that use the senses of sight, sound, and odor to indicate hazardous materials.

2 Describe the limitations of using the senses in determining the presence or absence of hazardous materials.

3 Identify typical occupancies and locations in the community where hazardous materials are manufactured, transported, stored, used, or disposed of.

4 Identify typical container shapes that can indicate hazardous materials.

5 Identify U.S. and Canadian placards and labels that indicate hazardous materials.

6 Identify facility and transportation markings and colors that indicate hazardous materials, including the following:
   (a) UN/NA identification numbers;
   (b) NFPA 704 markings;
   (c) Military hazardous materials markings;
   (d) Special hazard communication markings;
   (e) Pipeline markings;
   (f) Container markings;

7 Given an NFPA 704 marking, describe the significance of the colors, numbers, and special symbols.

8 Given the identity of various hazardous materials (common and proper shipping name, UN/NA identification number, or type placard), identify the fire, explosion, and health hazard information for each material by using the current edition of the Emergency Response Guidebook. The first responder at the awareness level shall be able to:
   (a) Identify the three methods for determining the appropriate guide page for a hazardous material;
   (b) Identify the two general types of hazards found on each guide page.

9 Identify the basic information on material safety data sheets (MSDS) and shipping papers that indicates hazardous materials.
   (a) Identify where to find material safety data sheets (MSDS);
   (b) Identify entries on a material safety data sheet that indicate the presence of hazardous materials.

10 Match the name of the shipping papers found in transportation (air, highway, rail, and water) with the mode of transportation.

11 Identify where the shipping papers are found, under normal conditions and during an emergency, and the person responsible in each mode of transportation.

12 Identify the entries on shipping papers that indicate the presence of hazardous materials.

Definitions

Introduction to Detecting Hazardous Materials

In Chapter 1, you learned that hazardous materials are not only widely used, but many are hard to detect. In this chapter, you will learn how to spot clues that can be used to detect the presence of hazardous materials. You will learn that agencies such as OSHA, EPA, NFPA, and DOT have determined regulations and guidelines for placarding and labeling certain quantities of hazardous materials located in fixed facilities and during transportation. However, you will not be able to solely rely on these placards and labels. You will be taught how to recognize clues that use your senses of sight, hearing and smell that indicate the presence of hazardous materials. However, you will also learn that using your senses can be extremely hazardous to your health and even deadly. Finally, you will learn how to use informational tools such as the Emergency Response Guidebook, Material Safety Data Sheets, and shipping papers.

There is Never A Routine Hazardous Materials Incident

As an emergency responder, **you need to use great caution when approaching a potential or known hazardous materials incident.** As mentioned before, there are no hazardous materials experts, because of the staggering numbers of hazardous materials being used. In addition, very little is known about the long-lasting health effects of the vast majority of chemicals in use.

There is no such thing as the "routine" hazardous materials incident. Regardless of how harmless an incident looks; whether you know the chemical, or it appears to be a small amount, a hazardous material is "hazardous" for a reason. For example, consider the number of people who never expected to be injured or killed when improperly using small amounts of gasoline.. **Treat each incident as your first, approach cautiously, plan carefully, and always keep safety as the primary focus.**

Finally, keep in mind that some common chemicals will react with one another when they are mixed. In addition, certain substances can be more dangerous depending on their form. For example, when powdered non-dairy coffee creamer is ignited, it can burn with explosive force. When ammonia and bleach are mixed, they form a toxic gas that can severely injure responders. Finally, smoke from rubber backed carpeting can produce deadly vapors such as hydrochloric gas. Therefore, **safety "vigilance and discipline" must be maintained, even if the scene seems to present little or no risk.**

General Clues

The safe handling of a hazardous materials incident begins long before your arrival. Detecting the presence of hazardous materials is the first step in having a successful outcome. For example, common sense will tell you if you approach a gas station, there is a hazardous material present. What happens, however, when you roll up on a

scene and find a black glass building with a large parking lot? Can you be certain that hazardous materials are not present? Too often emergency responders will assume that if the presence of hazardous materials is not outwardly apparent they are not present. Unfortunately, many of those same emergency responders are injured, disabled or killed.

If you are responding to the scene of a hazardous materials incident, use the outward signs that may suggest the presence of hazardous materials.

Collapsed Victims

If you see persons who are collapsed, vomiting, have severely watering eyes, uncontrollable coughing or other signs of respiratory distress in or around the hazardous area, it could be indicative of exposure to hazardous materials.

People Running from the Scene

People running from the scene of an incident almost always raise a red flag, especially to law enforcement personnel. However, this may be an indicator of a hazardous materials spill and should alert you to approach the scene with caution.

Picture courtesy of William Fletcher, Boone County Emergency Management

Flames or Smoke

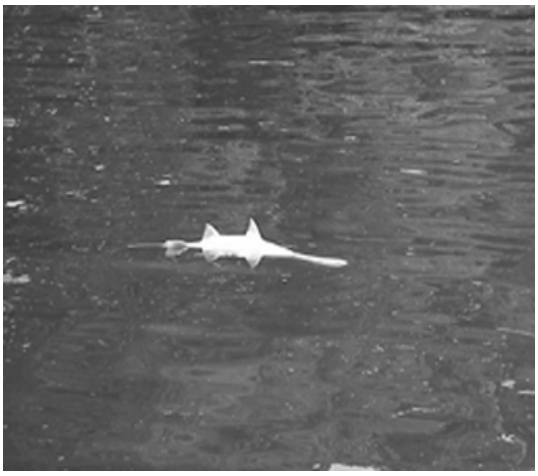
Smoke is a mixture of hot gases, carbon, and particulate materials. As stated above, a fire can alter the chemical composition of a material. Therefore, if smoke or fire is observed, the potential for exposure to emergency responders is greatly increased.

Rising Sound from a Venting Safety Device

As the pressure builds in a container, materials can be forced out of the container or the container can fail. A loud roar or high pitch from a container's safety device is an indicator of increasing pressure. This should alert you and increase your caution.

Hissing Sound

Leaking vapors may cause a hissing sound, much like air escaping a tire. This should alert you that the dangers presented by leaking vapors might be present.



Dead animals, fish, and insects may indiacte an environment that cannot sustain life. Be alert to these clues. Picture courtesy of the Natural Resources and Environmental Protection Cabinet.

Dead Birds, Fish, Animals, and Insects

Birds falling out of the sky, fish kills, and the absence of insects are often indicative of a hazardous materials spill. Earlier in the text, you read about the distillery warehouse fire in Anderson County where 250,000 gallons of whiskey spilled into the Kentucky River and killed nearly one million fish.

Other Clues

Although most hazardous materials incidents are unintentional and accidental, there is an increasing frequency of chemical, biological, ordinance and radiological (COBRA) terrorism and clandestine drug manufacturing facilities. Each of these situations poses serious threats to emergency responders. In some instances, there are explosive (ordinance) devices and other weapons of mass destruction (WMD) placed to injure or kill responders and the general public. However, there are clues that can alert you to their presence.

Unusual security locks, bars on the windows, covered windows, barbed wire, and surveillance equipment that appears inappropriate for the surroundings, probably is. Approach the scene with extreme caution. Be alert of the possibility of **secondary devices**. These devices are detonated or released after an initial detonation or release intended to injure a specific target(s), often emergency responders.

Also, keep in mind the potential targets of a terrorist. Public areas with high traffic or volume, such as convention centers, churches, theaters, stadiums, are targets for a would-be terrorist. Mass transit systems, such as the LEXTRAN bus depot or the buses themselves, and places with high economic impact are also targets. Government buildings, such as the federal courthouses in London and Louisville are probable targets for a terrorist attack. Telecommunications centers, like the KET production center in Lexington, also should be considered potential targets of a terrorist.

Hazardous materials and laboratory equipment that are not appropriate for the occupancy are also indicators of the presence of hazardous materials. Unexplained vapor clouds, mists, and plumes may indicate a release of a gaseous substance. Unusual tastes and odors may also indicate a hazardous materials release.

In Kentucky, there is an increase of clandestine methamphetamine manufacturing facilities, often referred to as "meth labs." Although more prevalent in the western part of the state, meth labs are moving east at an alarming rate. During the first nine months of 2000, one law enforcement agency responded to about 10 meth lab operations. During the last 3 months of 2000, the same department responded to more than 15 meth lab operations. These labs can be found in urban, rural and inner city areas, in fixed facilities and in car trunks. They use a dangerous mix of chemicals with improvised formulas that create extremely toxic gases.

The persons surrounding a hazardous materials release area can also provide clues that may help your response efforts. If you encounter persons who have a sudden onset of multiple illnesses; unexplained signs of skin, eye, and / or airway irritation; or twitching, tightness in the chest, sweating, pinpoint pupils, runny nose, and / or vomiting may indicate exposure to a hazardous material. Although initial responders may not see these signs, they may be helpful to law enforcement personnel who are gathering intelligence on a particular site.

Using your Senses

Throughout the previous section, you have learned of ways to use your senses to detect the presence of hazardous materials. However, using your senses to detect the presence of hazardous materials is a dangerous, potentially deadly method of detection. Using the clues mentioned above are helpful, however, by the time you are close enough to hear or see these clues, you may already be in an area considered to be "Immediately Dangerous to Life and Health (IDLH)." This designation means there is a concentration that is high enough to cause significant damage to your health.

Although using your senses can be helpful, it can also be dangerous. How often have you heard the story of the old leather lung fire chief, the crusty police sergeant, or the wet-behind-the-ears rookie that walks up to spill, touches the substance and then smells it or tastes it? This method of detecting hazardous materials is not only foolish...it can have deadly consequences. The use of taste, smell and touch are not accurate or effective methods of identifying a substance. They will result in exposure to the substance.

Remember the routes of exposure mentioned earlier in this text. They are ingestion, inhalation, injection, and absorption through skin or eye contact. Look at these closely; ingestion is accomplished through tasting a substance. Absorption is as easy as touching a substance and inhalation is as easy as smelling. The bottom line is that your safety and the safety of your team are of the utmost importance. **Do not approach, taste, smell, or touch any substance, known or unknown, without wearing the proper personal protective equipment (PPE) and level of training.** In addition, certain materials can cause damage to your sight. For example, chlorine can burn the eyes and burning magnesium can burn the retinas of the eyes. **As a first responder trained to the awareness level, approaching or sampling a substance goes**

well beyond your scope of training. You must be trained to the hazardous materials technician level before you learn to test a material to positively identify it.

Location and Occupancy

The location of an incident may provide clues as to the possible presence of hazardous materials. For example, if you respond to an incident at Dow Corning in Carroll County, and see a greenish cloud rising from the plant, you would expect that hazardous materials would be involved more than if you saw one rising over McDonalds. Likewise, if you made a response in the mid-summer to a man reported down in a field beside a high-boy, you might suspect that farm chemicals are involved.

Seeing tanks like the ones above are solid clues to the presence of a hazardous material. Based on the clues in the picture, how many different classes of hazardous materials may be present?

Occupancy also plays an important part in determining the presence of hazardous materials. Commercial laboratories, lawn and garden centers, manufacturing facilities, rail yards, storage sheds, disposal sites, etc., can have hazardous materials present. Another source probably not considered to house hazardous materials are large stores, such as Wal-Mart Supercenters, Super K stores (K-Mart), Big Lots, and others. These stores often have pool chemicals, automotive supplies, and sometimes propane gas cylinders. As you can imagine, these stores can pose serious threats to emergency responders during a fire or hazardous materials release.

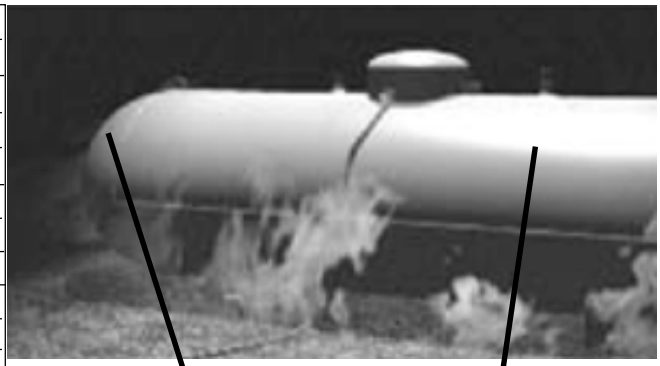
As you approach a scene take notice of whether the occupancy is a confined space, or the location is below grade. These factors can affect the concentration of toxic vapors and breathable air.

Unfortunately, there are exceptions to the rule. Clandestine drug labs are meant to be disguised. These labs may be in abandoned houses, basements, apartments, and numerous other spaces, including car trunks. In addition, the persons who operate these labs may place devices meant to injure or kill anyone who may not be welcome. Therefore, if you respond to a suspected lab, be alert for trip wires, bombs, things

hanging from trees, and other items that may seem inappropriate.
Except for these labs, the occupancy and location is a reliable clue to identify the presence of hazardous materials. It may be helpful to ask yourself as you approach a scene, "what is the likelihood that hazardous materials are being manufactured, used, transported into, or disposed of at this site?"

Container Shapes

Once you arrive at the scene, another valuable clue is the container shape. Your experience tells you that there are containers of all shapes and sizes that hold hazardous materials. Sitting by the railroad tracks watching a train pass or on a highway watching traffic go by provides a simple reminder of the variety of containers that carry hazardous materials. In addition, think about all of the smaller containers that you have come across that hold hazardous materials. From syringes to the million gallon oil tanks, there are many different sizes of containers for hazardous materials. In this section,



you will learn about the bulk packaging and non-bulk packaging containers. Your ability to recognize and identify these packaging types should alert you to the likely presence of hazardous materials.
In addition, the specific shape of a container may also provide clues to the dangers the contents of the container may present. For example, containers with rounded ends and made from heavy gauge metal usually contain contents under high pressure. Containers with flat ends usually indicate low pressure or non-pressurized containers.

Bulk Packaging

There are basically two types of bulk packaging that which is an integral part of the transport vehicle, and that, which is placed inside or on a transport vehicle. In the appendix of this book is a reference to the most common bulk rail and road cargo containers. These include railroad freight cars, such as hopper cars, boxcars and tank cars, as well as tank trucks and semi-trailers. Packages that are placed in or on a transport vehicle include ton containers, intermodal tanks, palletized non-bulk packages, and protective overpacks for radioactive materials called "casks."

Non-Bulk Packaging

Non-bulk packaging also comes in two basic types: single packaging and combination packaging. Examples of single packaging would be pails, barrels, drums, carboys, and cylinders. An example of combination packaging is fiberboard boxes containing multiple sacks or jars. Determining the presence of hazardous materials in non-bulk packaging is more difficult. Most vehicles that transport these types of packages are not placarded to alert first responders of the presence of hazardous materials. These

These are examples of non-bulk containers. However, these are shipped by the hundreds, even thousands. Most of the time, they are not placarded.

vehicles are also enclosed, requiring the vehicles to be opened to determine the presence of the hazardous materials. The exception to this is a flatbed truck. Another difficulty in determining the presence of hazardous materials in non-bulk packaging is that these materials are often not placarded or labeled because they are shipped just below the threshold quantity. An example of this may be small parcel shipping service that may deliver 100 pounds of sulfuric acid. This is below the placarding and labeling thresholds; however, the threat of the acid is still present.

The best policy is to proceed as though hazardous materials are present. A significant problem facing emergency responders is that hazardous materials in small container shipments can be found everywhere. Again, be alert for mobile drug labs in vehicles and the potential for farm chemical spills in Kentucky. **ASSUME HAZARDOUS MATERIALS ARE ALWAYS PRESENT IN VEHICULAR OR TRUCK ACCIDENTS.**

Markings and Colors

Markings and colors are important clues for detection of hazardous materials. However, they may not be present, especially if they have been burned or scraped off of the container. Business names, proper shipping names, and marking systems can provide you with a great amount of information from a safe distance.

Business Names

"Markings" refer to the name of the businesses known to deal with chemicals such as DuPont, Dow Corning, Marathon-Ashland, and so on. These markings can be

Company names may also provide clues to detecting a hazardous material. The pitcure above shows some of the numerous companies in Kentucky that maufacture, distribute, or store hazardous materials.

observed on the outside of transport vehicles, buildings, and even single containers from great distances by using binoculars. In many cases the Department of Transportation requires certain markings on containers that can identify, or at least help identify the specific hazardous materials being shipped.

Proper Shipping Names

The "proper shipping name" is the chemical or common name that the US Department of Transportation has authorized for a hazardous material. The proper shipping name must be listed on shipping papers and may be listed on the container.[1] It is also the name referred to by the UN/NA number. In the previous chapter, you learned that there were over 223,000 hazardous chemicals, however, it is important to understand that the *shipper* selects the proper shipping name that is used on the container and shipping papers. Many times the shipper will use a generic name such as "Flammable Liquid" with the initials "n.o.s.," *not otherwise specified.* In such cases you will likely find the technical name on shipping papers after the annotation n.o.s.[2] You may find the common or shipping name stenciled on the side of the container. This is a common practice for containers that are dedicated to carrying that particular material. If this is the case then your job has been made easier. However, this is the exception not the rule. Most often, you will find that the **proper hazard class** name has been used to satisfy the proper shipping name requirement.

UN/NA Numbers

United Nations/North American identification numbers are four digit numbers assigned to hazardous materials/dangerous substances. The numbers are used in Mexico, Canada, the United States, and in many of the United Nation member countries. Therefore, many foreign shipments will use this numerical system of identifying

hazardous materials. These numbers can be found on shipping papers, material safety data sheets (MSDS) and on placards. They serve as quick identification of the substance, provided that the container is labeled correctly. Also, these four-digit numbers are numerically indexed in the yellow-bordered section of the Emergency Response Guidebook (ERG). You will learn about the usefulness of the UN/NA ID system later in this chapter.

Other Markings

For certain chemicals shipped by rail, the US Department of Transportation requires that the proper shipping name be stenciled on the side of the railcar. Railcars shipping anhydrous ammonia, ammonia solutions with more than 50% ammonia and Division 2.1 and 2.3 materials require this marking. Again, these cars are dedicated to transporting this material as long as the name is stenciled on the car. Every container that is in service has numbers stenciled or stamped in certain areas on the container. These numbers mean simply that the container has been constructed to certain *specifications* to transport the specific hazard class.

Containers may also have exemption numbers to signify the US Department of Transportation's approval that allows the transport of certain hazardous materials in non-specific containers. An emergency response network, such as CHEMTREC may use these numbers to help identify the materials involved.

This symbol is used only on fixed facilities. Although not required it provides **ALL** first responders with a solid analysis of the hazards of the materials inside.

NFPA 704 System

If you are a firefighter, you are aware of the NFPA, National Fire Protection Association. The NFPA develops standards and guidelines for use by fire departments across the nation, including standard 704. NFPA 704 is a marking system developed for use at *fixed facilities.* This system provides you with an immediate assessment of the relative hazards of dangerous chemicals at a fixed facility that stores, manufactures, or uses hazardous chemicals.

This standard provides you with information concerning the health, flammability, reactivity, and other related hazards created by short-term exposure that might occur under conditions such as fire or other related emergency conditions.

As mentioned above, the system identifies the hazards of three principal areas;

"**health,**" "**flammability**," and "**reactivity**" or the instability of a material. The system indicates the *degree of severity* numerically by five divisions ranging from "zero (0)," indicating no special hazard to "four (4)," which indicates a severe hazard.
There are two ways each category is marked, by position and by background color. Health is always on the left and is blue. Flammability is on top and is red. Reactivity is on the right and is yellow. The fourth space located on the bottom of the diagram is used for special hazards such as water reactivity, radioactivity, corrosivity, or special protective equipment required in case of a fire or emergency.
It is important to remember that the NFPA 704 system is only used on fixed facilities and its use is voluntary.

Hazard Classification System
During transportation of hazardous materials, the rules are very different. The US Department of Transportation, Transport Canada, and the Mexican Secretariat of Transport and Communications mandate the use of the hazard classification system in transportation. You have already learned about the nine categories of hazardous materials. In this section, you will learn about a method legally required to identify those categories.
This method consists of **diamond shaped placards and labels placed on the shipping containers and/or the transport vehicles.** The information on these placards also appears on the shipping papers, which accompanies the regulated substances. If you see one of these placards or labels on a container or vehicle, you should consider it an indicator of the presence of hazardous materials.

Standard Transportation Commodity Code (STCC)
The railroad industry uses a seven-digit code called a Hazmat code to identify hazardous materials. The Hazmat code, formerly known as a Standard Transportation Commodity Code – or STCC (pronounced "stick") code, is assigned to many hazardous commodities. STCC codes are still used for other commodities. The Hazmat code is organized and coded to convey information about the primary hazard of a commodity and also about many potential additional hazards. Each set of numbers assigned to a commodity represents specific information about the commodity. However, you need to know that Hazmat codes or STCC codes that begin with 48 or 49 indicate that this is a hazardous material.

Biomedical Hazard Symbol
This symbol, which is also the symbol for the Centers for Disease Control, is frequently used to mark the shipments of biotoxins such as yellow fever, tetanus and polio, as well as containers of medical waste such as blood-soaked gauze or significant quantities of bodily fluids, or even tissues such as organs intended for transplant. Recognizing this marking or symbol on a container or building should warn you of the presence of hazardous materials.

Military Hazardous Materials Markings
Fort Knox in Meade County, Bluegrass Army Depot in Madison County, and Fort Campbell in western Kentucky all use the military hazardous materials marking system. This system, developed by the U.S. Department of Defense (DOD), uses a combination of geometric shapes, numbers, and colors to indicate the hazards. The symbols cover two categories of military munitions: conventional munitions and chemical munitions.

Conventional munitions are placed under Hazard Class 1, explosives. The DOD breaks the classification into four divisions, 1, 2, 3, and 4. These divisions correspond to the DOT hazard classification system divisions 1.2, 1.2, 1.3, and 1.4. The DOD placards for conventional munitions have black numbers on an orange background, however the shapes differ from the DOT placards. **Class 1, Division 1** (1.1) is an orange octagon with a number 1 in the center of the octagon. **Class 1, Division 2** (1.2) is an orange "X" with the black number 2 in the center of the "X." **Class 1, Division 3** (1.3) is the shape of an orange upside-down triangle, and a black number 3 is in the center. **Class 1, Division 4** (1.4) is a diamond-shaped orange placard with a black number 4 in the center of the diamond.

Chemical munitions fall under the DOT Class 6, poisons. Chemical munitions use both colors and figures to relay the hazard information. These symbols can relay a great deal of information, including what type of protective clothing is required during a release. These are called "sets." **Set 1 refers to toxic agents.** These materials are known as casualty agents and are designed to kill. The symbol for this group of agents is a round placard with a blue background and a red one-inch rim around the outside of the circle. Inside the blue circle is a red human silhouette in protective clothing. The military uses the slogan, "red is dead." **Set 2 refers to harassing agents.** These are materials such as tear gas and other riot control agents. The symbol for this group of agents is a round placard with a blue background and a yellow one-inch rim around the outside of the circle. Inside the blue circle is a yellow human silhouette in protective clothing.

Set 3 refers to illuminating agents and constitutes the bulk of the three sets. The symbol for this group of agents is a round placard with a blue background with a white one-inch rim around the outside of the circle. Inside is the blue circle is a white human silhouette in protective clothing. **The wear breathing apparatus** symbol is the fourth symbol in the chemical munitions group. It is a special designator that directs all personnel entering a marked area to wear a self-contained breathing apparatus (SCBA). This symbol is a round placard with a blue background with a white one-inch rim around the outside of the circle. Inside the circle is a white human face wearing a filter-type mask. The fifth symbol in the chemical munitions group is the apply-no-water symbol. It is a designator tat directs all firefighters to use water cautiously as an extinguishing agent. The symbol is a round placard with a white background. It has a broad red diagonal line and a circle superimposed over a black silhouette of a fire and a bucket of water.

Pipeline Markings
There are very few counties in the Commonwealth that do not have pipelines. Therefore, you need to be aware of the different markings associated with pipelines that you may

encounter.

Warning markings are probably the most common, since they are required by the U.S. Department of Transportation. They are round signs with a yellow background. The sign states "Warning," in black letters on a red background. Below this on a black background in yellow letters is a description of the pipeline, the pipeline company name, city, state, and the phone number. This information is uniform for all pipeline companies. You may also see "**Call before you dig**" signs or "**Toll free numbers**" markings on a post with the telephone number of the company.

Emergency Response Guidebook

As a first responder to hazardous materials incidents, one of the best tools you will ever use is the Emergency Response Guidebook, commonly known as the ERG. This small orange book can be found on nearly every piece of fire apparatus, in most police cars, in many public works vehicles, and in every emergency management office throughout the state. During the most recent update cycle of the book, Kentucky received more than 93,000 copies for distribution. Today you have received a copy of the book. If your department needs additional copies of the book, please contact your local emergency management agency or your Local Emergency Planning Committee. In this section you will learn how to use the ERG to help you recognize and identify the presence of hazardous materials **during the initial phase of a hazardous materials incident**. The initial phase is defined as the period following the arrival at the scene during which the presence and/or identification of a hazardous material is confirmed, protective actions and area securement are initiated, and assistance of qualified personnel is requested, in otherwords, about the first 30 minutes of an incident.

Although there are many important elements of this course, this section is perhaps the most important. Learning how to use this little book may mean the difference between seeing an incident end safely or seeing an incident escalate into deadly situation.

This book is not meant to replace training nor is this book meant to be a replacement for technical reference materials. The book provides general information that may be useful to the first responder.

Background of the ERG

Initially, the background of this book may seem irrelevant. However, as a first responder is it important to know that Transport Canada, U.S. DOT, and Secretariat of Transport and Communications of Mexico partnered in the development of the Emergency Response Guidebook. This means that the ERG is as relevant to shipments of hazardous materials coming out of Canada, such as the shipments that can be found on the Inter-Canada Railroad in western Kentucky, as it is to the shipments coming out of Calvert City in Marshall County.

This book is not intended to provide information on the physical or chemical properties of dangerous goods. **The ERG uses the term dangerous goods instead of hazardous materials**, however, for the purposes of this course, you will only see the term hazardous materials. Instead, the ERG provides information intended for decision-making during the initial phase of an incident.

Contents

The ERG has four main sections, each identified by the color of the page border. The yellow-bordered pages are an index of hazardous materials in numerical order of the UN/NA ID number. The blue-bordered pages are an index of hazardous materials in alphabetical order. The orange-bordered pages are 62 emergency guides. Finally, the green-bordered pages contain a smaller number of materials, including certain chemical warfare agents that pose a *toxic inhalation hazard* (TIH) or are water reactive and produce toxic gases when they contact water. **It is important that you become familiar with these sections before you have to use the book.** This class is a good start, but you should practice with the book often. Remember that time is of the essence when you are on a hazardous materials incident. The KyERC provides a course that provides further information on the ERG called, "2000 Emergency Response Guidebook." This course is recommended as a refresher for awareness level first responders.

Yellow-Bordered Pages

The yellow-bordered pages are a list of hazardous materials put in numerical order based on the UN/NA ID number. The section provides a quick identification of a hazardous material by using the 4-digit identification number. In addition some entries that are highlighted. **The highlight indicates a material that poses a "Toxic Inhalation Hazard."** For materials that are highlighted, turn to the green-bordered pages, unless there is a fire. The list displays the 4-digit number followed by the emergency response guide and the material name. Otherwise, you can turn to the orange-bordered guide number.

ID Number	Guide Number	Name of the Material
1017	124	Chlorine

If you encounter an entry with a "P" after the guide number, you need to be aware that a material may polymerize. Polymerization is a chemical reaction in which the material reacts with itself, usually in a violent heat-releasing reaction. The best-known example of this type of material is styrene. When the reaction is completed, the material becomes polystyrene, the white, spongy plastic material that makes your disposable coffee cup.

ID Number	Guide Number	Name of the Material
2055	128P	Styrene Monomer, inhibited

Blue-Bordered Pages

The blue-bordered pages are a list of hazardous materials placed in alphabetical order by the proper shipping name. However, there may be more than one name for a material. This list provides a quick identification of a hazardous material by using the name of the material. The list displays the name of the material followed by the emergency response guide number and the 4-digit identification number. In addition some entries are highlighted. **The highlight indicates a material that poses a "Toxic Inhalation Hazard."** For materials that are highlighted, turn to the green-bordered pages, unless there is a fire. If there is a fire you must turn to the orange-bordered guide number indicated.

Name of the Material	Guide Number	ID Number
Liquefied Petroleum Gas	115	1075

If you encounter an entry with a "P" after the guide number, you need to be aware that a material may polymerize. Polymerization is a chemical reaction in which the material reacts with itself, usually in a violent heat-releasing reaction. The best-known example of this type of material is styrene. When the reaction is completed, the material becomes polystyrene, the white, spongy plastic material that makes your disposable coffee cup.

ID Number	Guide Number	Name of the Material
2055	128P	Styrene Monomer, inhibited

Orange-Bordered Pages

This is the most important section of the ERG. Within these pages, all of the safety recommendations are given. Information that addresses the potential hazards, public safety considerations and emergency response actions is all contained in these guides. The left hand page provides safety related information and the right-hand page provides emergency response guidance and considerations for fire, spills and leaks and first aid information. Most of the guides are designed to cover a **group** of materials possessing similar chemical characteristics. The guide title identifies the general hazards of the dangerous goods covered. For example, Guide 111 covers "Mixed Load or Unidentified Cargo" materials. **Each guide contains GENERAL response information.**

The "Potential Hazard Section" is sub-divided into two sections, "fire or explosion", and "health hazards." Either the "Fire or Explosion" or the "Health Hazards" may appear first in the listing on the page. Whichever one is first indicates the more severe hazard.

"Public Safety" is divided into three sections, General Information for Responders, Protective Clothing, and Evacuation. "Emergency Response" is divided into three sections, Fire, which includes evacuation and isolation information; Recommended Extinguishing Agents; and when to use unmanned monitors (high volume hose streams) and withdraw from the area. Finally, Spill and Leak Procedures and First-aid information are included in the orange guides. KEEP IN MIND that if the material is highlighted in the blue- or yellow-bordered pages and there is no fire, **you must turn to the green-bordered pages**.

Green-Bordered Pages

The green-bordered pages contain information about toxic information hazards and water reactive materials. The table provides two different types of recommended safe distances that are "Initial Isolation Distances" and "Protective Action Distances." As mentioned above, the materials with a TIH are highlighted in the blue- and yellow-bordered pages for easy identification.

The green-bordered pages list materials by the UN/NA identification number. Therefore, before you can use the table, you must know the UN/NA number before you can use the table.

If the material is on fire, then you must use the orange-bordered pages for evacuation distances. If there is no fire then you will use the green-bordered pages. There are two different distances in the green-bordered pages and it is important that you understand the difference in the two.

The Initial Isolation Distance is a distance that the chemical is expected to reach during the first 30-minutes of an incident. Therefore, **the initial isolation distance requires that you must *isolate* for 360 degrees around the release**, defining what is commonly known as the "hot zone."

The Protective Action Distance involves that area downwind, downhill and downstream from the spill or release where people may come in contact with vapors. These distances are provided to protect the public downwind, downhill and downstream from the spill or release.

Toxic Inhalation Hazard (TIH)
A toxic inhalation hazard is a liquid or a gas that is known to be so toxic to humans as to pose a hazard to health during transportation, or in the absence of adequate data, is presumed to be toxic. The determination of whether a material is a TIH is based on the lethality of the substance.

Water Reactivity Section
Many materials are reactive to water. Many of these substances are listed in the green-bordered pages. This section should only be used when the materials are spilled in water or when firefighting will cause a water reaction. The types of toxic vapors released in a water reaction are listed in this section. Keep in mind that many water reactives, such as potassium, may produce heat and may be violent in nature. The heat produced from a water reaction may be enough to ignite ordinary combustible materials. The chemical names of vapors released from a water reaction must be researched in the blue- and green-bordered pages to determine what orange guide page to use. Isolation and evacuation distances should be determined from the orange- or green-bordered pages.

Tools In the ERG
In the front of the ERG, there is a set of general safety precautions and suggestions of who to call for assistance, including emergency phone numbers. In addition, there is a list of the hazard classification system and a table of placards.

Rail Car and Road Trailer Charts
The Rail Car and Road Trailer Identification Charts are only to be used when you are not able to get the name or the UN/NA number of a material. **THE RAIL CAR AND ROAD TRAILER IDENTIFICATION CHARTS ARE USED ONLY AS A LAST RESORT WHEN NO OTHER INFORMATION IS AVAILABLE.**

Hazard Identification Codes
Hazard Identification Codes are used in some European and South American countries. These are used on orange rectangular panels on some bulk intermodal containers posted above the 4-digit identification numbers to identify certain hazards associated with a substance.

Likewise, after the orange-bordered pages and before the green-bordered pages is a section of white pages that are an introduction to the table of initial isolation and protective action distances. These pages provide detailed directions in using the green-bordered pages.

Finally, there is a section of white pages that follow the green-bordered pages. This section contains information about protective clothing, fire and spill control, the use of chemical and biological agents and a glossary.

How to use the ERG

Using the ERG is a fairly simple, methodical process.

Step One: <u>Identify the material</u> through one of the following actions:

1. Find the 4-digit identification number on the placard or orange panel.
2. Locate the 4-digit number on a shipping document or package.
3. Find the name of the material on a shipping document, placard, or package.
4. If an ID number or name of a material is unavailable, the Table of Placards, Guide 111, or Railroad/Road Trailer Charts should be used.

<u>Step Two:</u> <u>Look up the material's 3-digit guide number.</u>

1. In the yellow-bordered pages number index.
2. In the blue-bordered pages name index.

<u>Step Three</u>: If the **<u>entry is not highlighted</u>** in the blue or yellow index then turn to the numbered guide in the **<u>orange-bordered pages</u>** and read carefully.

OR

If the **<u>entry is highlighted</u>** in the blue or yellow index, determine the 4-digit ID number and turn to the **<u>green-bordered pages</u>** and read carefully.

Later in this section, you will have an opportunity to use the ERG to identify hazardous materials. It is important to note that the ERG is most useful in transportation incidents, and less useful for incidents at fixed facilities. However, the ERG remains to be one of the best tools for the first responder at a hazardous materials incident. **<u>Remember, the ERG is useful only during the initial phase of the incident, which is about the first 30-minutes.</u>** Again, the KyERC provides a course that gives an in-depth look at the Emergency Response Guidebook.

Shipping Papers

Inside the front cover of the ERG is a generic diagram of shipping papers. These documents can provide information to the first responder that will assist in determining the vital information of the materials involved. The locations of shipping papers will vary depending on the mode of transportation involved. For trucks, the shipping paper, or "Bill of Lading" is located in the cab of the truck, usually in the driver side pouch if the truck is occupied, or on the drivers seat if the truck is unoccupied. For trains, the "CONSIST" or "waybill" is located in the locomotive or on with a member of the train crew. On a ship or barge, the "Dangerous Cargo Manifest" is located in the wheelhouse, or in the case of barges, in a small mailbox on the barge. In airplanes, the "Airbill" is in

the cockpit with the pilot.

Material Safety Data Sheets (MSDS)

Employers are required to maintain any Material Safety Data Sheet, commonly known as an MSDS, by OSHA 29 CFR 1910.1200. This regulation, known as Hazard Communication (HAZCOM) standard, mandates that workers who deal with a hazardous material be given information describing the dangers of the material. This transmission of information is through labels, placards, MSDS, and other forms of warning. This program has an added benefit to first responders by providing them with the vital information of the materials on the site.

As mentioned above, MSDS provide useful information to responders at a hazardous materials incident. At minimum, MSDS's will have the following information:

1. The identity used on the label, except for trade secrets.
2. The chemical and common names of the material or all of the ingredients which comprise 1% or more, or .1% of a chemical known to be a carcinogen.
3. Physical and chemical characteristics, such as vapor pressure and flash point.
4. The physical hazards of the hazardous chemical, including the potential for fire, explosion, and reactivity.
5. The health hazards of the hazardous chemical, including signs and symptoms of exposure, and any medical conditions which are generally recognized as being aggravated by exposure to the chemical.
6. The primary routes of entry.
7. The OSHA permissible exposure limit (PEL), ACGIH Threshold Limit Value (TLV) and other exposure limits used or recommended by the chemical manufacturer.
8. Whether the hazardous chemical is listed in the National Toxicology Program (NTP) Annual Report on Carcinogens or has been found to be a potential carcinogen.
9. Any generally applicable precautions for safe handling and use that are known. This includes appropriate hygienic practices; protective measures during repair and maintenance of contaminated equipment, and procedures for clean-up of spills and leaks.
10. Emergency first aid procedures.
11. The date of preparation or the date of the last change to the MSDS.
12. The name, address and telephone number of the chemical manufacturer or responsible party preparing or distributing the MSDS. In addition, there is a listing of who can provide additional information on the hazardous chemical and appropriate emergency procedures.

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Chapter 4

Scene Survey and Hazard Assessment

Terminal Objectives

By the end of this chapter, the student will be able to:

Analyze the incident to determine both the hazardous materials present and the basic hazard and response information for each hazardous material by surveying a hazardous materials incident from a safe location to identify the name, UN/NA identification number, or type placard applied for any hazardous materials involved and collecting hazard information from the current edition of the *Emergency Response Guidebook* in a safe, efficient and effective manner.

Enabling Objectives

By the end of this chapter, the student, to a proficiency of 70%, will:

1. Define what hazardous substances are and what risks are associated with hazardous substances in an incident.
2. Given examples of facility and transportation situations involving hazardous materials, the first responder at the awareness level shall identify the hazardous material(s) in each situation by name, UN/NA identification number, or type placard applied. The first responder at the awareness level shall be able to:
3. Identify difficulties encountered in determining the specific names of hazardous materials in both facilities and transportation.
4. Identify sources for obtaining the names of, UN/NA identification numbers for, or types of placard associated with hazardous materials in transportation.
5. Identify sources for obtaining the names of hazardous materials in a facility.

Definitions

Introduction to Scene Survey and Hazard Assessment

By now, you may have noticed that there has been little mention of how to approach a scene. This is not by any accident. Approaching a scene of a hazardous materials incident is important, and is covered in this course. However, there is a great deal of information you must have before you can approach the scene…SAFELY and EFFECTIVELY.

You have learned a great deal of information already. You have learned how to identify the presence of a hazardous material. You have learned about the dangers hazardous materials can pose. Now, it is time to start piecing all that you have learned together. In this section, you will learn how to take the single components you have learned in chapters one, two and three and begin building a systems to **EFFICIENTLY** and **EFFECTIVELY** do a scene survey (size-up) and assess the hazards that are present; this will ensure your **SAFETY** and the **SAFETY** of the public and the **SAFETY** of you crew. Take note of the bolded words: effectively, efficiently, and safety, safety, safety.

Safety is the most important concern on a scene, whether it is a fire, motor vehicle collision, flood, hazmat, or anything else. The Kentucky Emergency Response Commission, Kentucky Fire Commission, Kentucky Law Enforcement Council, Kentucky Labor Cabinet, and a whole host of other commissions and councils at the federal, state and local levels are sincerely and consciously concerned with your safety. The #1 premise of this course is safety. Therefore, safety is deliberately mentioned and always understood.

Chapter Layout

This section will require your hands-on participation. You will reap what you sow in this part of the class. Perhaps the cliché is too much, but it is true. To this point, you have invested nearly five (5) hours of your life into this course. In this chapter, your instructor will give you a brief lecture and then you will be broken into groups, given a series of scenarios. You will be asked to provide as much information as possible about the photos you see.

Some pictures are difficult to make out. Some pictures are impeded due to poor light, smoke or distant. This is intentional. The reason is very simple, you won't respond to many scenes where everything is up close and crisply in focus and easy to identify.

Keep safety as your number one priority.
The safety of you, your crew, the public, the environment and property is your primary goal.

Do the best that you can.
This is a learning experience. The test will be later. Do what you have been trained to do for the last five hours. If you make a mistake, don't be embarrassed. Own it and learn from it.

If you err, err on the side of safety.
You are probably sick of hearing it, but safety is the most important consideration of this course. If you have to make a judgment call, make it on the side of safety. Again, this is a learning environment. It is best to learn lessons here when you can make mistakes without dire consequences. However, by erring on the side of safety as you train, you will begin to establish a pattern that you will follow in the field. So if you err, err on the side of safety.

If you are in over your head, admit it, and act on that.
You are being trained to the first responder awareness level in hazardous materials emergency response. It is called "awareness" because the intent is to make you aware of the threat of hazardous materials so that you can protect the public, the environment and property from the effects of a release of a hazardous material. You are expected to start the process of protecting the public, the environment and property by initiating the notification process, controlling access to the site, and implementing the Incident Management System.

There is nothing in this description that says you will contain a spill or release; nor is there anything that states you will repair a container or stop the leak. These things require a greater amount of training. Therefore, you must know your limitations and when to get help. If this is a problem for you, then you should no be on the scene of a hazardous materials release.

Size-Up Considerations

Size up, or scene assessment, is important to your safety and the safety of your crew. There are several things you must consider from the moment that you are dispatched through your arrival on-scene until you equipment is put back into service, and even

beyond. From the time you are dispatched to an incident, you are being fed information. The caller or dispatcher will tell you where you are going and why, sometimes. The cloud over the hill gives you information as does the lack of traffic, dead animals, and things you see on you arrival. However, you must stay alert and bear in mind that the information given to you may be inaccurate or incomplete. Use the signs given to you in earlier chapters to determine the presence of a hazardous material. In order to guard your safety and the safety of your crew, you must identify the presence of hazardous materials before you or they are exposed. What follows is a simple list that shows you the least to the most dangerous clues to detecting the presence of hazardous materials.

1) Review the information the caller or dispatcher provides you that may indicate the presence of hazardous materials.
2) Review the occupancy, location or local emergency operations planning documents for indications of hazardous materials.
3) Look for container characteristics that indicate hazardous materials.
4) Look for hazardous materials markings
5) Look for placards and labels
6) Review shipping papers for hazardous materials entries.
7) Use your senses (i.e. sight, hearing, smell) to detect unusual circumstances that may indicate the presence of hazardous materials.

Resource Arrival and Positioning

Do not let your run get off to a bad start. When you approach the scene, approach from an upwind, uphill and upstream position. Do not let your equipment or personnel become contaminated before they even get to the scene.

As you approach the scene, particularly if you are approaching an unknown scene, **stay at a safe distance.** Learn to use binoculars and/or the telephoto lens of a camera. These are the hazardous materials emergency responder's most valuable tools.

Initiate the Notification Process in the local Emergency Operations Plan (EOP)

One of the additions made to the 2000 ERG was to call 911. One might ask, "Why?" The answer is simple, people, even trained emergency responders were not calling 911 to initiate the notification process. Someone assumed that someone else was calling. In most of the communities in Kentucky, 911, whether from a cellular phone or from a landline will contact the 24 hour point of contact for that community.

When you call that number, you should have certain information to provide. For a second, put yourself in the shoes of the people you are calling. What would you want to know as you are rolling up on the scene? The location, your name, the situation, etc. In the ERG, there is a list of information you should have to communicate to the National Response Center (NRC). This is a great reference to use to determine what information you should have before you call. Use this in the exercises.

Control Access to the Site

This is a necessary, important task. You must restrict access to the scene and control who is leaving the scene so you can protect health, environment and property. If someone was contaminated, and spread the hazardous material outside of the "hot zone" or "exclusion zone" then you may have a second hazardous materials incident. In the same way, if an untrained person went into the "hot zone," that person would run a great risk of doing serious damage to his or her health and possibly cause rescuers to further risk their lives to save him or her. Controlling access to the site is serious and important.

Finally, Implement the Incident Management System (IMS)

The Incident Management System provides a safe and effective means of managing an incident. It establishes who is in charge and who will do what actions. If you are not familiar with the Incident Management System (IMS) ask your instructor about when the next Introduction to Incident Management System class is. This course provides a two-hour introduction to the concepts of the Incident Management System.

KENTUCKY EM INCIDENT LOG **Page 1**

GENERAL INFORMATION

INCIDENT#:		**TIME REPORTED:**	
DATE:		**TIME OCCURRED:**	
COUNTY:		**COMMUNITY:**	
INCIDENT LOCATION:			
TIME NOTIFIED:			
REPORTED BY:		**AGENCY :**	
PHONE:			

SITUATION REPORT

# INJURIES:		**# DEATHS:**		**# EVACUATIONS :**	
# SHELTER:		**LOCATIONS:**			
STREAMS AFFECTED:					
PROPERTY DAMAGE:					
ROADWAYS CLOSED/DETOURS (MM):		**EXPECTED OPEN:**			
EXPECTED ALL- CLEAR TIME:					

WEATHER

TEMP		**DEW POINT**		**WIND SPEED/DIRECTION**		**PRECIPITATION (RAIN, SNOW, ETC)**	

TYPE OF INCIDENT

HAZMAT		NATURAL HAZARD		TRANSPORTATION		OTHER EVENT		SEARCH/RESCUE	
SPILL		THUNDERSTORM		RAILROAD		TERRORISM		LOST PERSON	
AIR RELEASE		TORNADO		HIGHWAY		MEDICAL		DROWNING	
FIRE		FLOOD		AVIATION		CIVIL DISORDER		USAR	
EXPLOSION		WINTER STORM		PIPELINE		EVACUATION/SHELTER		MISSING AIRCRAFT	
CSEPP		EARTHQUAKE		MARINE		UTILITY/WATER		HIGH ANGLE	
ADIOLOGICAL		OTHER		OTHER		OTHER		CAVE	

INITIAL INCIDENT INFORMATION

(USE INCIDENT JOURNAL, PAGE 10, FOR CONTINUATION)

STATE STAFF ROLE:		**INCIDENT COMMANDER (WHO)**	

INCIDENT ACTION PLAN:	**YES**		**NO**		**DATE/TIME**		
SITE SAFETY PLAN	**YES**		**NO**		**DATE/TIME**		

ENTUCKY EM INCIDENT LOG

HAZARD INFORMATION

CHEMICAL NAME	AMOUNT RELEASED/ SPILLED	UN #	GUIDE #	CAS # PLACARD	TOTAL AMOUNT	CHARACTERISTICS		
						FP	LEL	UEL

HS	YES		N0		RQ (AMT)		CERCLA	YES		NO		RQ (AMT)	

STATE

SOLID		LIQUID		GAS		LIQUID COMPRESSED GAS		PURE		MIX		WASTE		OTHER	

HAZARDS

RROSIVE		ACTIVE TOXICITY		DELAYED		TOXICITY		FIRE		REACTIVE		SUDDEN RELEASE		RADIO ACTIVE	

RESPONSIBLE PARTY INFORMATION

MPANY			
NTACT PERSON			
DRESS			
Y, STATE, ZIP			
ONE			
AIL			
X			

CLEAN-UP CONTRACTOR

EAN-UP CONTRACTOR			
NTACT PERSON			
DRESS			
Y, STATE, ZIP			
ONE			
X			
A			

INCIDENT ACTION AND SAFETY PLANS

TION PLAN	YES		NO		DATE/TIME	

INCIDENT ACTION PLAN

INCIDENT PRIORITIES

1ST	LIFE SAFETY	
2ND	INCIDENT STABILIZATION & PROTECTION OF THE ENVIRONMENT	
3RD	PROPERTY CONSERVATION	

WHAT IS THE PROBLEM?

STRATEGIC GOALS

TACTICAL OBJECTIVES

TACTICAL OBJECTIVES	RESOURCE ASSIGNMENT PER OBJECTIVE

PLAN SUMMARY

MITIGATION MEASURES

PROTECTIVE ACTION ZONES [DESCRIBE]

INITIAL ISOLATION ZONE RADIUS		SAFE REFUGE DISTANCE EMERGENCY WORKERS	
EXCLUSION (HOT) :			
CONTAMINATION REDUCTION (WARM):			
SUPPORT ZONE (COLD);			

DECONTAMINATION AND PPE

ZONE	LEVEL PPE	DECON LOCATION SITES
HOT		
WARM		
COLD		

EMERGENCY EVACUATION SIGNAL(S) AND ROUTES FOR WORKERS

SIGNAL	ROUTE

POPULATION PROTECTION ALERTING/WARNING

METHOD OF ALERT	SIGNAL

BEGIN EVACUATION TIME	END EVACUATION TIME	IN-PLACE SHELTER/ BEGIN TIME	IN-PLACE SHELTER/ ALL CLEAR TIME

EVACUATION ROUTES	

MISCELLANEOUS

GENERAL INFORMATION

INCIDENT#:		TIME REPORTED:	
DATE:		TIME OCCURRED:	
COUNTY:		COMMUNITY:	
INCIDENT LOCATION:			
TIME NOTIFIED:			
REPORTED BY:		AGENCY :	
PHONE:			

SITUATION REPORT

# INJURIES:		# DEATHS:		# EVACUATIONS :	
# SHELTER:		LOCATIONS:			
STREAMS AFFECTED:					
PROPERTY DAMAGE:					
ROADWAYS CLOSED/DETOURS (MM):				EXPECTED OPEN:	
EXPECTED ALL- CLEAR TIME:					

WEATHER

TEMP		DEW POINT		WIND SPEED/DIRECTION		PRECIPITATION (RAIN, SNOW, ETC)	

TYPE OF INCIDENT

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FIRE		FLOOD		AVIATION		CIVIL DISORDER		USAR	
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ADIOLOGICAL		OTHER		OTHER		OTHER		CAVE	

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STATE

SOLID		LIQUID		GAS		LIQUID COMPRESSED GAS		PURE		MIX		WASTE		OTHER	

HAZARDS

RROSIVE		ACTIVE TOXICITY		DELAYED		TOXICITY		FIRE		REACTIVE		SUDDEN RELEASE		RADIO ACTIVE	

RESPONSIBLE PARTY INFORMATION

MPANY			
NTACT PERSON			
DRESS			
Y, STATE, ZIP			
ONE			
AIL			
X			

CLEAN-UP CONTRACTOR

EAN-UP CONTRACTOR			
NTACT PERSON			
DRESS			
Y, STATE, ZIP			
ONE			
X			
A			

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TION PLAN	YES		NO		DATE/TIME	

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ZONE	LEVEL PPE	DECON LOCATION SITES
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COLD		

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EAN-UP CONTRACTOR			
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